HINDU ZODIAC

and

Ancient Astronomy

K. CHANDRA HARI

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K.Chandrahari: Born in 1961, holds an M.Sc in Physics from University College, Trivandrum and M.Tech from Institute of Technology, BHU, Varanasi. Had an accidental entry into the researches in Indian antiquity and history of astronomy while in quest of a rational definition of the Zodiac inspired by astrology. Present work 'Hindu Zodiac and Ancient Astronomy' forms Volume – I of his researches and hopes to present astrology in the language of science in a subsequent volume.

Owes his inspiration to pursue the study of Physics and Jyotihsâstra to his parents: Sri. K.V.Chandran Nair & Smt. M.N.Meenakshi Amma, Kizhakkekûttu house, Kadapra, Kumbanad, Kerala and maternal uncles: Sri. Ramakrishna Pillai and Late. Sri. M.R.Narayana Pillai, Manjanamkuzhiyil, Ayiroor. Present work is dedicated to them and to all those who have showered their affection onto the author.

Further, this work is dedicated to:

- All those who have sacrificed their lives for the sake of humanity
- All those who have sacrificed their lives for my country, India
- All those who have pursued the mystery of human destiny

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Transliteration of Sanskrit Alphabets

a ā i ī u ū ṛ e ai o au

k	kh	g	gh	ň
c	ch	j	jh	ń
ṭ	ṭh	ḍ	ḍh	ṇ
t	th	d	dh	n
p	ph	b	bh	m

y r l v ś ṣ s h ḷ

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Foreword

Slowly but steadily the modern physical sciences are moving towards a realization that the existential dilemmas are unanswerable in terms of the empirical science as an insurmountable limit awaits rational inquiry. Scientific progress was not at all a product of rational inquiry alone as may be easily understood from the speculative jumps that the reason had taken recourse to at many critical moments in the history of science. Reasoning at times could be led to its perfect and complete state only with the aid of intuition and interception of facts that were lying beyond the extant radius of the thinking horizon. An incomplete, imperfect state that raises puzzling questions or imbroglios often awaits a creative leap and that had been the state of studies on Indian antiquity and especially the history of Jyotiḥśāstra until now. In terms of chronology and history the ancient literature and the archaeological evidences presented a paradoxical situation while Jyotihśāstra with its claim of 'Ṛṣiprōktaṃ' stood to gain only disgrace by contrary hypothesis of alien origin and contradictions that it presented in its post Āryabhaṭa phase. Present work *Hindu Zodiac and Ancient Astronomy* is a creative attempt to answer all such intricacies that have been plaguing historical studies and Jyotiḥśāstra since the beginning of the modern age of reason. In fourteen sections, Chandra Hari has dealt with all important aspects of the genesis, scientific rationale, and historical as well as religious significance of the Rāśicakra and has not left any controversy without a convincing answer. Apparent absurdity of Hindu calendar vis-à-vis ayanāṃśa, abstract Vedic hymns, apparently meaningless customs and traditions of Hindu way of life and the unbelievable episodes of Mahābhārata and Rāmāyaṇa receive thorough explanation with irrefutable astronomical evidences. Historical research in India meets with a new direction – present work heralds a serious quest with the aid of modern astronomy to decipher the chronology cryptically inscribed in the myths of ancient literature.

This is a work that takes us to the remote past – a past of which we had no idea at all – to the days of great Ṛṣis or Tāntrics who have laid the scientific foundation of our civilization and heritage. Despite the esoteric circumstances of the genesis of the work, it encompasses a most scientific thesis on the origin and rationale of Zodiac that surpasses the Government of India/ Council for Scientific and Industrial Research (CSIR) sponsored Calendar Reform Committee report prepared by the great scientists and astronomers of our country. Citrapakṣa Zodiac can no longer claim any scriptural or scientific basis in view of the irrefutable evidences Chandra Hari has presented in favor of Mūlādhāra Rāhu Śikhi Cakraṃ. As shown by Chandra Hari, Lord Śiva is Mūla tārakaṃ and Siva's mahima is beyond description and so is the greatness and truth of Mūlādhāra Rāhu – Śikhi Cakraṃ:

Asitagirisamaṃsyāt kajjalaṃsindhupātre
Surataruvaraśākhālekhanīpatramurvī I
Likhatiyadigṛhītvā śāradā sarvakālaṃ
Tadapitavaguṇānāmīśa pāraṃ na yāti II*

* "The greatness of Śiva shall prove inexhaustible even if a mountain of carbon dissolved in the ocean and the branches of Kalpataru is used by Śārada to write the same on the surface of earth till the ω of time".

Astronomical evidences presented have already appeared in the Indian Journal History of Sciences and has thus undergone the scrutiny of academicians. As far as the unpublished part of the work is concerned, conclusions such as 'the epic locations are celestial' in fact are warranted by the futility of the archaeological quests and an astronomical explanation for the epic episodes serves to explain many such paradoxes that we encounter in Indian historical research.

The single most outstanding historical contribution of the work is that it places Indian antiquity over a Yoga – Āgama – Jyotiṣa based Tāntric cum Vedic foundation that had a universal influence in shaping the astronomy and philosophy of the rest of the world. Further, the astronomical interpretation of the Purāṇic episodes renders them the status of 'more sensible accounts' than the "mythological nonsense" it is apparently. It is worth noting here that in the absence of supportive archaeological evidences Mahābhārata and Rāmāyaṇa could have evoked only laughter from historians and whereas the 964 BC epoch deciphered from the astronomical interpretation of the accounts provide them a new credibility and chronological value. This is especially important when we note that we are unaware of any historical details of the epoch of 964 BC – we had no reason at all to believe hitherto that India had a civilization comparable to the one we see portrayed in Rāmāyaṇa or Mahābhārata in such an antiquity. Another important aspect in the astronomical interpretation is the conflicting and irreconcilable accounts that suggest redaction at different epochs: As for example, when analyzing the war diary of Mahābhārata we see that the war beginning of the new moon of Jyeṣṭha, winter solstice on the 68th day after and 'Balarāma's pilgrimage' are irreconcilable and the configuration of war-beginning and Uttarāyana suggests the possibility of an earlier epoch. In Rāmāyaṇa too it is easy to understand that the Rāma-Rāvaṇa war of Caitra is incompatible with the legend and tradition of Vijayadaśami and this contradiction alludes to the possibility that the germ of the story is more deep rooted in time than the extant Rāmāyaṇa.

We can see here that many of our customs do have inscribed in them an astronomical rationale and in fact such customs were instituted to serve as a record reflective of such important astronomical rationale. We see for example, in a Śiva temple the instruction that one should not cross the channel (Gaṅgā) while doing pradakṣiṇaṃ, he has to return anticlockwise to the deity in simulation of the ascend of Kuṇḍalinī from Mūlādhāraṃ to Sahaśrāraṃ. In the present work we see the enlightening answer that the custom is reflective of the zodiacal position of Mūla – the fiducial star of the Kālacakra personified as Mahākāla – at 240^0 where Ākāśa Gaṅgā cuts the Sūryapathaṃ. Many of our scholars may hesitate to believe that the Tāntric tradition dates back to an antiquity of 4137 BC but such a mind-boggling antiquity stands established by Chandrahari's work. Also in the work we find the astronomical aspects and original epoch of the founding of celebrations such as Kālāṣṭami which in subsequent years became Kṛṣṇāṣṭami and Vāmana Jayanti vis-à-vis Indradhvaja celebrations etc.

In the light of Government of India's decision to introduce Jyotiḥśāstra in Universities it was most necessary to see that the controversy on the Zodiac and ayanāṃśa is once settled for ever. Without a rational definition of Rāśicakra, it was impossible for Jyotiṣa to gain the stature of a science and the teachers would have found themselves in an unenviable situation in trying to answer the questions on Zodiac and ayanāṃśa. Chandra Hari has done this job most scientifically and I am sure that no scholar, astronomer, or

astrologer who has the capacity to understand a scientific work shall attempt to challenge the validity of the Mūlādhāra Rāhu Śikhi Cakraṃ as described in this work. Any covert attempts to silently perpetuate other erroneous Zodiacs like Citrapakṣa and Revatīpakṣa (in the name of tradition) are despicable and I hope all honorable men having faith in Jyotiṣa and Kuṇḍalinī shall desist from doing such acts calamitous to the Hindu society. A truly computed horoscope as per the Mūlādhāra Cakra has the efficacy of a Yantra and the planetary longitudes conceive their respective esoteric power only when computed with reference to Mūladhāraṃ. Any departure in this regard shall amount to self destruction as a result of sinful deeds as ordained in the Gītā:

Yaḥ sāśtravidhimutsṛjya vartate kāmakārataḥ I
Na sa siddhimavāpnoti na sukhaṃ na parāṃ gatiṃ II 17-23 II

Tasmācchāstraṃ pramāṇaṃ te kāryakārya vyavasthitouI
Jñātvā śāstravidhānōktaṃ karma kartumihārhasi II 17-24II[†]

It is therefore binding on all those who are involved in fixing the 'time factor' of the Hindu way of life to study and understand the present work with a scientific spirit and to adopt the Mūlādhāra Rāhu-Śikhi Cakra as the basis of Jyotiṣa with immediate effect. Those who follow the Āgamic worship and turning a deaf ear to the pulse of the True Zodiac are bound to face the wrath of the esoteric powers if truth underlies the Yoga – Āgama – Jyotiṣa foundation. In the days to come we have here an opportunity to find a demonstration of the occult power of Kuṇḍalinī with people who are treading a path subversive to Tantra. If a perceptible manifestation of the esoteric power is lacking in the contrast between the use of Mūlādhāra and other Rāśicakras, Jyotiṣa may be deemed to be a folly rather than Śāstra. It must be noted here that Tantra is a discipline that abhors belief in favor of reason and experience and as such the validity of Jyotiṣa can never be a question of belief. It is said in Bhāgavataṃ:

Yaśca mūḍhatamōlōke yaśca budheḥ paraṃ gataḥ I
Tāvubhau sukhamedhete kḷiśyatyantaritō janaḥ II[‡]

We all know that this is very true in the case of astrologers and priests – there are some who are least bothered of the scientific practice and are driven exclusively by business motives. These social parasites enhance their prospects by unfair marketing strategies with pseudo claims of prophetic excellence and purchased doctorates. It is the duty of all those who have faith in the true religion to save the society from these people.

On the question of Hindu calendar too author has rendered scientific answers. The sāyana – nirayana conflict is shown to be meaningless. Viṣus and ayanas obviously have to be considered with reference to the equator but this in no way requires the sāyana zodiac. We need only to understand the position of the celestial equator in relation to the sidereal or stellar reference. I am sure that Śrī Krishen Kaul and other sāyana advocates shall find themselves in a very unenviable predicament in continuing their tirade against

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[†] (23): "Grace, happiness and mukti evades the one who forsakes the śāstra in his work. (24) Therefore, Sāstra must be the basis of life and one is supposed to know and act as ordained by the Śāstras".

[‡] "Only the idiots and the extraordinary geniuses can be happy in this world. Those in between these extremes find the world as misery".

sidereal zodiac. As is the case with Indian scholars Śṛī. Kaul may find it below his dignity to change the stand he has taken. It must be clearly understood that the calendar and horoscope are too different things as the Prajāpati of the Vedas and Mahākāla of the Tantras and those who intend to challenge or denounce the Tāntric time may meet with the same fate as that of Dakṣa Prajāpati. As can be understood from the Purāṇas when men lose track of time the only recourse is to approach Mahākāla Rudra, the fixed reference star Mūla.

As far as the interpretation of the Vedas are concerned too, the present work place before us a significant observation that Sanskrit terms in their application in the Vedas/ancient literature carry different meanings and may not be amenable to easy and simple translations and interpretation of the hymns has to be made with reference to the special contexts in which the cryptic, paradoxical or irrational use of terms may appear. It is certainly enlightening to note that the first of the hymns itself has an astronomical import and is not at all the expression of a poetical fancy inspired by the fire of hearth and heaven. True identity of Agni or fire-god is shown to be astronomical vis-à-vis reckoning of time/calendar and this interpretation casts a number of question marks over the prevailing assessment of the Vedas. In the days to come it is hoped that the Ṛks shall receive their true interpretation in terms of the heavenly canopy from which they were abstracted.

In the light of University Grants Commission's decision to adopt Jyotiḥśāstra as a scientific discipline, present work is indispensable to provide a rational physico-mathematical ground for the discipline. It is often alleged by critics that astrology defies a conceivable operational mechanism. This argument employed to decry astrology's status as a science does not stand in good stead in the light of the revelation that destiny is a manifestation of the esoteric power Kuṇḍalinī, that finds physical demonstration in Yogis. The fact that Yogic power lay beyond the horizon of modern biology is no justification to deny a valid observation of the mystic power of Yoga. If Yogic power is a reality there is absolutely no ground for science to outcaste Jyotiṣa and on the contrary science must gear itself to examine and discover the secret behind the occult phenomena. The macrocosmic – microcosmic interactive frame defined relative to the star λ-Scorpii is the common foundation of Yoga, Āgama and Jyotiṣa and as such the physical verification that Yoga offers is a valid substantiation for Āgama and Jyotiṣa as well.

In the coming years we can hope to receive an equally valid presentation of astrology proper, in the unambiguous language of modern science from the author. As may be noted in the present work Chandra Hari is the only author who has clarified without doubt that the birth time required for astrological purposes is the moment of first cry and this moment is mathematically computable by Kundaguṇanaṃ if the true sidereal longitudes are used for horoscope.

The last two sections added as appendices is apparently an effort to complete the discussion that the author had initiated in preceding sections. As far as the Indian origin of the Zodiac and astronomy is concerned no doubt shall remain after going through the details furnished in 'India – Original Home of the Zodiac'. 'Indian Chronology – A Reapprisal' but stops short of answering conclusively the controversies on the dates of Maurya dynasty, Buddha and Śaṅkara. The details furnished are certainly helpful in taking the quest for truth forward in the right direction. As may be understood from the author's preface it was an uphill task to meddle with so many divergent fields as

astronomy, history, Vedas, Tantra, Jyotiṣa etc., in seeking the right definition of the zero point of Zodiac, that the author himself is not happy about the aesthetics of presentation he has achieved and it therefore looks quite improper to make any criticism in this regard.

As the author has expressed in his preface, the present work "Hindu Zodiac – Mūlādhāra Rāhu Śikhi Cakraṃ", imparts a complete fulfillment to the prophecy made by Brahmaśrī Mithran Nampūtirippādu almost twelve years earlier. In these twelve years Jupiter has made a round of the heavens with Saturn moving from Sagittarius to Taurus, managing a transformation of the author from a fiery spirit to a calm witness to the unfolding drama of life. Today on 12th October when I am putting down these words, author is beside me with his plans to conclude the present enterprise in astronomical and historical research with a pilgrimage to Śabari Hills, the abode of Yogārūḍha Śāsthā and then to Mūkāmbika in the third week of October. He had entered the area of astronomy and history in quest of the True Zodiac and it ends obviously with the presentation of Mūlādhāra Rāśicakraṃ.

In scribing this forward, I have guarded myself from becoming a victim of the established notions. Being acquainted with the author's spirit since long, I had no difficulty in capturing the frame of his mind and objectively understanding his approach, deductions, as well as conclusions. With efforts so directed I could have found out and mentioned a few drawbacks but I haven't done it as the truth contained in this work outshines all other demerits and it is truth, truth alone that merits our attention. To all those who value Indian heritage, Chandra Hari offers a delightful sojourn into Indian antiquity and a real taste of its ancient wisdom in sharp contrast to the established notions. Understanding the contents needs exposure to the disciplines of astronomy, mythology, history, ancient Indian literature etc and systematic study of the various quotations given with due attention to their implications on the issues discussed. I wish the author and the readers all success in continuing their studies,

Dr. Ajeya Kumar

12 – 10 – 2001
Ettumanūr

Divibhūmou tathākāśe bahiranthaśca me vibhuḥ I
Yō vibhātyavabhāsātmā tasmai sarvātmane namaḥ II

Preface

i

Aśṛāvyavācyatatvena durdarśajñānamūrtinā
Bhuvanāni vidaṃbyante kena cidbhṛamadāyinā

"World apparently is a magic show by someone silent, invisible, beyond words and cognition..."

Man has ever been seeking a meaning or purpose for his existence in this vast, incomprehensible world. Driven by selfish genes, he looked for purposes all around, realizing little that nature is simply callous – lacking all purposes – and Man evolved by accident. About fifty thousand years before the present, accidentally he had risen above a threshold and found himself capable of manipulating his environment. He felt an identity distinct from Mother Nature and since then he had been in anguish troubled by existential questions such as: Who am I? What brings me here? Where I shall cease to be?

In trying to answer these questions, he has created innumerable gods, scriptures and metaphysical conundrums but that have only added to the confusion with which he began his quest for truth. See for example, what Vasiṣṭha has spoken to Rāma:

Dīrghasvapnamimaṃ viddhi dīrghaṃ vā cittabhṛamaṃ I
Dīrghaṃ vāpi manōrājyaṃ saṃsāraṃ raghunandana II

Put it briefly, life's an illusion - this is what Vedānta preach. Life whether an illusion or truth, Man a king or a sage or a fool, in real terms man experiences life as a struggle – 'a tale told by an idiot full of sound and fury signifying nothing'. The intellectual frustration that stems from the failure of our efforts to comprehend the meaning of our existence in fact leads to no other conclusion. To circumvent this situation Ṛṣis of the ancient past discovered the path of Tantra out of which the Indian philosophic tradition evolved. In modern times, under a strange paradigm of hypocrisy the literary works of the Ṛṣis came to be regarded as of more significance than the religion they practised. Attempts to understand the Ārṣa works devoid of their background has reduced the authors of Vedānta and works like Gītā and Yogavāsiṣṭham into the likes of modern sociologists/psychologists attempting to anchor the inquiring minds over pretentious beliefs/conundrums capable of doping the inquiring spirit to sleep. The tradition of Kṛṣṇadvaipāyana and Vasiṣṭha maintained by Ādi Śaṅkara and other Vedāntists has become today apparently a bunch of traps of words – jargons as incomprehensible as the worldly existence.

This enigmatic situation arose due to no fault of the Ṛṣis. With the degeneration that happened in the practice of religion it is quite natural that superficial intellectual deliberations came to dominate the theatre of religion. Similes and stories were invented to cover the inquiring spirit with a dark cloud of pretentious beliefs. Inquiry beyond these similes became unwelcome and Ācāryas found themselves comfortable in the company of hypocrites. Interpretations that the ancient Indian religion has received in the last few centuries is absurd in view of the fact that the modern thinking has altogether thrown into oblivion the core of the Hindu religion – Tāntric vision and practice of religion. Without Tāntric wisdom Hindu religion defies its interpretation and as such we have come to practise a pseudo religion in recent times. The intellectual quest that humanity had begun some fifty thousand years back and the realization of truth that the Ṛṣis managed a few millenniums behind – both have gone into a sleep doped by hypocrisy and pretensions.

Considered against the above background of Hindu society, present work contains the results of an inquiry into the truth of ancient Hindu wisdom – into the truth of Jyotiṣa that forms the backbone of Hindu religion. Through this work Jyotiṣa rediscovers its true mathematical and philosophical rationales and a scriptural or tāntric foundation and presents before the world the true esoteric conception of Time – the ultimate of Hindu Gods – as Mūlādhāra Rāhu Śikhi Cakraṃ. None can miss to see over this tāntric instrument (Yantra) of faith, the Upaniṣadic exhortation:

Uttiṣṭhata mā svapta I Agnimicchatvaṃ Bhāratāḥ II

"O, Bhāratāḥ (pursuers of light), Shake off the indifference and kindle the flame... (Śṛīcakra has made its advent again)"

ii

We can find the loftier dimensions of the inquisitiveness of Man reflected in the hymns of the Vedas and Upaniṣads:

Tamasō mā jyotir gamaya

This craving for wisdom to answer the innumerable questions sprouted in the minds of the meditative conscience of the Ṛṣis brought forth many disciplines of study in to existence bearing upon Man and his existence. The topic of the present work is concerned with the two most important streaks of that fabric of wisdom woven by the Ṛṣis viz., Man's evolution and existence within the ambit of Nature and the meaning of His existence. Ancient wisdom called the mystery of Man's day-to-day existence as Destiny and chose to explore this invisible aspect with the visible star lit sky and the ominous or portentous spectrum it offered and thus emerged the discipline of Jyotiṣa, which we may roughly render in to English as Astronomy. In the myths, legends and scriptures of all parts of the world we can see the different stages of its early development often described as primitive imagination by the modern mindset. But a little of reflection can bring to the fore of our minds the realization that the modern science is founded upon those primitive concepts like the sexagesimal gradations of a circle and the decimal number system for which we are yet to find a more convenient alternatives. As far as human creativity is concerned a classification as primitive or modern is quite absurd and

it is only time that makes things primitive and modern with the paradigm shifts that occur in human thinking as a result of many successive stages of development or a sudden spurt or avalanche of creativity. As far as astronomy is concerned great strides have taken place during the last half-a-millennium and the original discipline has almost lost its shape and relevance with new aims and impediments that characterize it today. Present work is a look back into time to trace the origin of Jyotiṣa or in other words in search of the original precepts of Indian astronomy and Zodiac combined with the aim of understanding the scientific and creative vision behind the concepts of Zodiac and astrology that have remained topics of much neglect and contempt ever since the days of Edmund Halley.

Genetics describe Man as the only surviving streak of the genus Homo and credits the ancestry of all Homo sapiens to an African mother. This common origin today stands camouflaged by the racial spectrum of Man and the diverse cultures and scriptures he has given rise to. Geographical and historical causes have split the single species into variant cultural traps that have very little of common traditions and heritage except for those which have arisen from astronomy and astrology. Beneath the diversity of cultures we can find the universality of zodiacal signs, weekdays and the astrological symbolism as a common thread of cultural inheritance from a hitherto unidentified prehistoric source. Same can be said about the metaphysical doctrine of soul and salvation on which all scriptures carry a hazy and confusing picture. None has any idea as to what precisely is the definition of the zodiac vis-à-vis astrological symbolism or what may be the rationale of soul and salvation, which all religions have spoken about!

• Where from humanity has inherited these strange conceptions surrounded by an aura of confusion?

For a devout Hindu his religion and astronomy are inseparable – zodiac as an instrument of faith stands on a par with the scriptures – but in this modern age of reason both runs on faith rather than on the realization of the underlying true rationale. This work is primarily concerned with the astronomical origins of Hindu Zodiac or Rāśicakra and its scientific / tāntric rationale in contrast to the erroneous prevailing conceptions. In the Hindu antiquity riddled with confusion established notions place the Vedic period around 1500 BC, after the doom of the Indus Valley civilization at the hands of invading Aryans. This modern sense of history founded on the theory of Aryan Invasion has been the touch stone of all historical researches in independent India during the last half-a-century. As far as the history of the zodiac is concerned the Calendar Reform Committee (CRC) headed by Dr. M. N. Saha conferred recognition on a similar plank – Citrapakṣa that placed the maximum possible antiquity of Hindu zodiac to AD 285. Moreover, in the deliberations of the Calendar Reform Committee not a single voice addressed the possibility of a sidereal zodiac different from the seasonal frame of Calendar: The following points of the CRC proceedings are noteworthy:

Point no: 11 of the decisions taken in the first meeting:

"(11) The chairman pointed out that it was for the committee to discuss and decide whether the year was to be brought back by 23 days or to leave the mistake as it was and to retain a permanent constant error. He also pointed out that such a mistake had occurred in Europe and corrections had to be introduced. The Gregorian year in 1582

was found to have an error of 10 days. Pope Gregory XIII advised that the 5th October should be called the 15th October. This was adopted by the Catholics..."

Further we can see:

• Dr K. L. Dafthari laid emphasis on the fact that our present calendars were absurd in the sense that the seasons were moving backward and wanted that this should be stopped.

• "The following resolution was adopted: '...*a scientific Civil Solar Calendar to be henceforth called the National Calendar for purposes of dating should have its first day after the Vernal Equinox day, viz. on the 22nd March, but for religious purposes in places where solar calendar is used, 13th or 14th of April may be the first day of the year for some time to come (as a concession to the prevailing custom)...*

• Page 16: "*It was explained in these notes of Prof. Vaidya that the Meṣādi of Sūryasidhānta was actually the V. E point, and as the seasons and different solar and lunar months of the year are connected with Meṣādi, the year of the Indian religious calendar cannot but be the seasonal or tropical year. It has also been shown that it is not possible to arrive at any definite conclusion as to the actual amount of ayanāṃśa at any epoch, from an examination of the star positions given by the Sūryasidhānta*".

• Dr. K. L. Dafthari (p.19):"*That the Dharmaśāstras and the Vedas regard only the seasonal year as the year, is clear from the statement in the Śatapatha Brāhmaṇa - The seasons is the year. The year can stand only by the help of the seasons. In view of this statement it is clear that we will do real justice to the Dharmaśāstras if we understand by Caitra etc. the Sāyana Caitra and by Aśvini etc. the Sāyana Aśvini etc. If we do not approve of the adjective Sāyana we may apply the adjective 'Cala'which is more expressive...*"

• Dr. Gorakh Prasad (p.20): "*I have already suggested above that it is confusing to accept the seasonal year for some ceremony and sidereal year for other. It is better to hold that even the words Chaitra, Vaishakha etc. imply the particular season and to take the seasonal year and seasonal months for all ceremonies...*"

It is amply clear from these observations of the CRC Members that in the religious thinking or scholastic evaluation of the precepts of Dharmaśāstras there was no place for the sidereal zodiac and the tradition was looked upon as an error. CRC did invite opinions from scholars and religious leaders of different parts of our country but none came forward to defend the (nirayana) Rāśi Cakra under the mesmerism created by the seasonal Vedic calendar. Sidereal zodiac received mention as an erroneous tradition perhaps in view of the insistence of N.C. Lahiri, who had the realization that astrology shall otherwise become meaningless. Proceedings of the CRC, the discussion that we can see in the 'History of Bhāratīya Jyotiḥśāstra II by S.B Dikshit, and of late the deliberations by Krishen Kaul etc eloquently suggest that the Tāntric time had gone into oblivion much before the known beginnings of the history of Hindu astronomy. We should not allow ourselves to be swayed by the wrong notion that is popular among a section of the intelligentsia that astronomy and astrology have their origin after the advent of Āryabhaṭa and Varāhamihira in the sixth century AD. This work therefore represents the dawn of a new chapter in History of science and I have no hesitation in admitting that its genesis was inspired by astrology.

It is a well-known fact that the contemporary opinions tend to cause inertia in human thinking and tend to hinder the originality and progress in research. In the words of Boring:

"It is always hard to be original, to make progress in a minority thinking that goes against the majority. In science, moreover, even the dead help to make up the majority, for they communicate by the printed word and by transmitted conventions of thought. Thus the majority, living and dead, may slow up originality".

Notwithstanding such limitations or conditioning imposed over the thinking, this work presents a Zodiac – Mūlādhāra Rāhu Śikhi Cakra – whose origins can be traced to the conscience of the Great Sages who lived around 4000 BC. In objectively evaluating the thesis presented, it is hoped that the prevailing notions and the transmitted conventions of thought won't pose a hurdle too high for the intelligentsia to cross.

iii

This is not a book meant for the general reader – this is a book for those who have interest in occultism, in the esoteric dimensions of human existence. It may be lacking in many respects as presentation, aesthetics, maintaining diplomacy and hypocrisy etc that the modern mindset demands, but which have no relevance as far as an occultist is concerned. As such the whole effort was directed towards an understandable presentation of truth with as much evidences as possible without caring for what a typical reviewer may say on the face of it. The spirit of this book shall remain beyond the reach of all superficial readers and on the contrary to any serious student - to all Bhāratās - this book shall certainly render an invitation into the intricacy of Indian antiquity and the mysteries of human existence. I have dealt with the subject matter in twelve chapters and a few appendices have been added to provide certain information, which I considered as shall be of interest to an average reader.

Chapter I present the historical context of Jyotiḥśāstra and the conflict between legends and modern historical notions while II is a sojourn into the history of Indian civilization with emphasis on the intricacies involved. In Chapter III we begin the quest for true zodiac within the corridors of Siddhāntic astronomy followed by detailed analysis in the fourth section on 'ayanāṃśa' and the fifth chapter entitled 'True Sidereal Zodiac'. Mūlādhāra Rāhu-Śikhi Cakra is shown to be implicit in Sūryasiddhānta and the absurd conceptions such as Citrapakṣa and Revatīpakṣa are shown to be incompatible with the mathematical framework of Śūryasiddhānta. Considered with modern precision, vernal equinox – the zero point of modern astronomy – coincided with the initial point Aśvinyādi of Mūlādhāra Cakra in AD 233. Original Sūryasiddhānta is shown to be based on the vernal equinox of AD 231 that coincided with Caitra śukḷa (1).

Chapter VI presents the astronomical interpretation of the tāntric iconography of Mahākāla Śiva and determination of the prehistoric epoch of ancient Indian astronomy. VII deals with mystery of time and destiny in relation to the tāntric philosophy and the pretentious jargon of modern Vedānta. Chapter VIII contains an overview of studies on Vedic astronomy while IX is a discussion on the astronomical basis of Hindu religion and

the true astronomical rationale of the important Hindu religious festivals. Chapter X is 'Astronomy of the Epics' an attempt to date the latest redactions of both Rāmāyaṇa and Mahābhārata based on an astronomical interpretation of the epic story lines.

Chapter XI entitled 'On the Touchstone of Established Notions' profiles the genesis of the present thesis and the story of the conflict it had with the notions of established scholars. It also has two important unpublished papers 'Ancient Indian versus Babylonian Astronomy' and 'Kṛttikās, Great Bear and the Antiquity of Vedic Astronomy'. Last chapter, the XIIth has two papers dealing with the astronomical interpretation of mythology: 'Indradhvaja – A Pointer towards Vedic Antiquity' and 'Date of Kṛṣṇa and the Mahābhārata War'.

I have also given two important appendices viz., 'India – Original Home of the Zodiac' and 'Intricacy of Indian Chronology – A Reappraisal' in which I have given details that I considered as facilitative of better conclusions on related controversies. Even in respect of Ādi Śaṅkara, I have not attempted to impose my conclusions on the reader – I have only furnished the relevant astronomical details. The feeling that the date of 509 BC is a kind of jugglery crept into mind only very late when I had occasion to re-read the paper of TSK Śāstry. In India the astrologers in general and those who have amateurish interest in the subject have no easy access to information on the historical background of Zodiac and astronomy and as such they have been victims of/swayed by established notions such as that of the Calendar Reform Committee and the perverse propaganda taking place through astrological journalism. I have resorted to give extensive quotations on all the important aspects so that those who are interested in the subject may understand the issues in detail. All beginners to the study of history of Zodiac or ayanāṃśa need to read and re-read such accounts by scholars to understand the different facets of the issue and the intricacy of the truth that evaded them.

Present work, in fact is only a beginning in many respects and much work remains to be done in establishing the Hindu way of life on its real scientific/astronomical foundations and also in realizing the true identity of Vedic literature as a branch of the tāntric wisdom. As observed by Galileo: "*I do not doubt that in the course of time this new science will be improved with still further observations, and even more by true and conclusive demonstrations. But that need not diminish the glory of the first observer...*"

iv

A hundred years back Svāmi Vivekānanda has spoken the words – "*If there is one word that you find coming out like a bomb from the Upaniṣads, bursting like a bombshell upon masses of ignorance, it is the word fearlessness. And the only religion that ought to be taught is the religion of fearlessness. Either in this world or in the world of religion, it is true that fear is the sure cause of degradation and sin. It is fear that brings misery, fear that brings death, fear that breeds evil. And what causes fear? Ignorance of our own nature*" – Despite such exhortation of the Upaniṣads as referred to in the above words, fear has succeeded in becoming the overriding emotion of the present day Indian society as it chose to relegate the tāntric spirit, an inquiring mind and the quest for realization, to the background. It was in such forgetfulness that the Cāturvarṇyaṃ got imposed over the society and the casteless, classless society of ancient times got divided... and ultimately

the majority of the populace was denied of their religion. The true Indian religion is Tāntric, it is universal, abhors any sort of differentiation between the humans in the matter of his right for worship, and all our scriptures form the common heritage of humanity. In the absence of Tantra, Vedas have no religious meaning, it allows variant interpretations, and we have been carrying the Vedas as such through many ages. Brāhminism was a spiritual tradition but its degeneration into casteism or Cāturvarṇyaṃ is neither the Hindu religion nor a spiritual tradition. The so-called anti-humanistic utterances in certain scriptures are most probably interpolations of subsequent times rather than a part of the 'ārsa' wisdom of Śrutis and Smrtis. Custodians of the caste oriented social order or religion are unconcerned of the true meanings or scientific basis of our instruments of faith. They have survived only on the strength of wrong traditions and political patronage they received. When we look back into the history of Hindu religion, we can see that the caste and class divisions have absolutely no contribution to our spiritual heritage and it was the tāntric spirit that came to its rescue as we see in Rāmakrishna and Svāmi Vivekānanda. Hindus have no 'Papacies' worth that name or religious organization and therefore it is of no meaning to wait for a papal decree to refine our religious practices. Under the present circumstances we can only hope for a forthright review of the issue of Hindu calendar by Ācāryas, especially those who preside over the Jñānapīṭhaṃs established by Ādi Śaṅkara. It is delusion to consider the Vedas and Upaniṣads as belonging to any caste or community or ascribing spiritual supremacy to those who preside over institutions that have lost their religious zeal. Vedas enjoin upon all to tread the path of Dharma and seek the truth and any religious seat or institution acting on the contrary and engaged in the 'religious business' of sponsoring pseudo religion deserves no cognizance of the true spiritualists. The triplet of sciences Jyotiṣa, Yoga and Āgama constitute the bulwark of universal Hindu religion (Tantra) and they are founded on the scientific Tāntric conception of Time, Mūlādhāra Rāhu Śikhi Cakra. Any other zodiac is antireligious, spells spiritual degeneration, and brings misery to life. Such degeneration in fact has brought our society into the sad state that we see today – a society devoid of its Dharma, gripped by selfishness and fear. It is therefore essential to have the Pañcāṅga and Kuṇḍalinis made accordingly and right efforts in this direction are a must for the well being of Hindu society.

What is the hallmark of spiritual wisdom? It is the ability to identify the truth. Don't believe in any saint or god who cannot prove what they preach before your conviction. Always remember that since the advent of Ramakrishna (who never put on the attire of god) many 'gods' had their parade before us but never have we been fortunate to find the transformation of a Narendra to Vivekānanda. Many of our so-called religious institutions have sycophantic brigades of scholars, astrologers, and yogis like the ants eating the corpse and following the dictates of these people shall render life certainly a wasteful effort. Identifying these unscrupulous exploiters of our heritage is not a difficult task – every individual in whom the pulse of Kuṇḍalinī is apparent must confront these men with the question:

- What is the identity of the true zodiac, what is its significance to the Hindu way of life and what have they done to arrest the proliferation of zodiacs based on irrational and unscientific conjectures?

Make an effort to understand their double standards in dealing with this question and expose them – this is the duty of every spiritual being!

V

As certain leftist historians tend to do, I have not attempted to color my conclusions on Indian or epic history with the notions of an ideological group. I could have easily portrayed Rāma as a real king born in 964 BC in Ayodhya or Kṛṣṇa on similar lines on the strength of the astronomical evidence I have given. Mahābhārata war too could have been presented as a true historical happening. Truth is more important to me than my political beliefs and so I have desisted from twisting the facts to serve rightist propaganda. But I am to assert that Ayodhya shall never be located in Afghanistan or in any other parts of Central Asia as an Aryan settlement as has been recently prophesied by a scholar who wanted to credit the Vedic heritage with an alien origin. Similar shall be the fate if we are bent upon looking for Triveṇi and Sarasvati in Prayāg – the terrestrial Gaṅgā, Yamuna and Sarasvati could never have met at Prayāg as is evident from geography. Triveni is a Tāntric term for confluence of Iḍa, Piṅgala and Suṣumna and the same was simply applied to describe the major confluence at Prayāg without caring for the strict literal meaning. First and foremost we must remember that the epics contain the story of the solar and lunar races and the terrestrial origin of the clans is subsequent to the genesis of the respective epics. It was from the epics that the names and titles were drawn and not vice versa. The fact that the epics do not represent actual historical personalities in no way discounts the grandeur of ancient Indian civilization. On the contrary the astronomical interpretation of the epics adds a hitherto unknown historical dimension to the epics – they stand to attest the existence of a scientifically advanced civilization – advanced and antique, even beyond the wild guesses of historians – in Indian soil and as archaeological evidence suggests in the Indus and Sarasvati valleys. Indus and Sarasvati valleys or South India or Mesopotamia has to render the archaeological evidence of an advanced civilization to which we can trace the origins of the Tāntric and Vedic streams of Indian culture. Whatever may be the place of origin, the key to unlock that heritage is Tantra and that only India is in possession of.

It is true that these new revelations tend to reduce the scope of the worship of the epic heroes that is deeply rooted in the Indian psyche. But we must remember that the hero worship had been the bane of all civilizations that made people forget the ideals represented by the heroes. A journey from the myths into their real meanings may be on the long run more rewarding than entertaining a religiosity founded on false historical notions. Hindu society is very much in need of a shift of their focus from the heroes to their ideals for their survival in the emerging future. We have ample evidence illustrative of the fact that only the ideals have come to our rescue in troubled times and not the heroes.

vi

A word I think is necessary on the genesis of this work without which its strengths and weaknesses cannot be taken in the right perspective. Just as the aesthetic appearance of a tower does not reveal the crude outline of the scaffolding used in its construction, present work had its humble beginning in trying to resolve the ayanāmśa controversy based on faulty reasoning / inexact premises in the year 1994. With little knowledge of astronomy, history, and Sanskrit and away from academic circles it was a fight against many odds to understand the intricacies of Indian astronomy and its historical

background vis-à-vis Vedic connection. Established notions and its proponents have been always irrational in dealing with the Mūlādhāra Cakra and have only tried to distort the evidence I have presented in its favor. But as the Mahābhārata says:

> Ekaḥ Śāsthā na dvitīyō*f*sti Śāsthā Garbhe śayānaṃ puruṣaṃ śāsthi Śāsthā I
> Tenānuśiṣṭaḥ pravaṇādivāmbhō Yathā niyuktōsmi tathā bhavāmi II

I have pursued the work inspired exclusively by my inner voice and the knowledge I have gained during the last seven years has only reinforced my faith in the truth of Mūlādhāra Cakra. I have passed through a period of trials and tribulations but in the company of a supernatural power that sustained my enthusiasm despite all odds that tend to curtail it. I have always been reluctant for an irrational acceptance of the manifestation of something supernatural in the world. But when I look back into the 12 years that have passed since a critical moment I have encountered on 27th November 1989, it is my objective mind that resists the effort to deny the role of supernatural in paving the way for the resurrection of Mūlādhāra Rāhu-Śikhi Cakra. This re-creation of the true zodiac that was lying buried below eons of time could not have been facilitated by what we call as intuition, because intuition needs a frame of thought for its descend to bridge certain critical gaps in our thinking – whereas in this case absolutely nothing was known of a tāntric tradition of astronomy even though the term Mūlādhāraṃ in retrospect appears to be pregnant with astronomical meaning. The situation is compelling as to admit the role of some mystic power in the process – I have received immense help and guidance on many occasions and as was prophesied by Brahmaśrī. Mithran Nambūtirippād, the thesis developed in my mind as a recollection inspired by apparently accidental observations. In retrospect I myself wonder as to how I could become so resolute in pursuing an idea that had its genesis in an error-strewn theory, which gave the true values of ayanāṃśa that I published in 1994. Astrological conviction of the truth of the derived ayanāṃśa values played an important role in making me resolute in the pursuance of further evidences but that alone was not the factor – an element of mystic experience had been there certainly. Situation reminds of the genesis of Tantra attributed to mystic unidentifiable sources in the distant antiquity. Masters of Tantra – esoteric wisdom had no attachment to their names and hence no effort to glorify names in the ancient esoteric literature. According to Tantra, every piece of wisdom was the result of sādhana and the *real preceptor was the mantra* itself rather any person acting under the behest of niyati. As such personal pride in any work of this sort is utterly meaningless. What is being told of Patañjali offers the best illustration for the way in which the preceptors of the Tāntric disciplines obscured their names: Kārkōṭaka nāga had a heated argument with Mahākāla and in duress the Lord threw him off his abode. Nāga fell in someone's hands [añjali] on the earth and so was called Patañjali. The only detail available is that he was a Nāga, and the term Kārkōṭaka is a cryptic reference to Āśleṣā nakṣatra – the nakṣatra of great esoteric potential. Names such as Vālmīki, Vyāsa etc are also likewise cryptic and do not serve personal identification. Unfolding of the present thesis in fact has opened before the author doors of a greater mystery of which I found an apt description in Kaṭhōpaniṣad:

> Natatrasūryōbhāti nacandratārakaṃ namōvidyutōbhānti kutō*f*yamagniḥ I
> Tamevabhānthamanubhātisarva tasyabhāsā sarvamidaṃ vibhāti II

A more scientific phrasing of the mysterious power cannot be thought of. Śrīvidya is the combine of all forces – the ultimate unified field or its manifestation in biosphere– perhaps

altogether functionally different from its constituents that has risen above a threshold facilitative of the occult phenomena – the treasury of man's infinite potentialities waiting to be awakened, invited and absorbed by man. In familiar terms, Kuṇḍalinī – the focus of all Mantra, Yantra and Tantra, the creative form of which terrestrially occupy the place Kuṭajādri, famous as Mūkāṃbika – author certainly owes an acknowledgement of her divine grace.

vii

I owe special thanks to certain individuals who have contributed immensely to my well-being during the last seven years [1994 – 2001] of my engagement in this work. The best way I can express my gratitude to all such people is by a sincere prayer to the Lord who resides over the Mūlādhāra Rāhu-Śikhi Cakra along with his nine accomplices to keep all of them above all wants and happy for ever, away from all miseries. The names that I cannot forget to mention are Śṛī. KRT Nair, Śṛī. PRG Pillai and Śṛī. TG Ramakrishnan who have been of constant support to all my endeavors. Inclination for confining me to solitude has reduced the friends' circle to a few individuals – Suresh, Vineet, Roy, Gopalakrishnan, Govindaraj and Dhavan, who have contributed indirectly in facilitating the work under publication.

Two years after the release of 'True Ayanāṃśa' (1994), Rāśicakraṃ (Malayalam) was published in 1996 and soon it was realized that all over Kerala the sincere researchers in astrology could realize the truth of Mūlādhāra Rāhu Śikhi Cakra. During the last five years a few such individuals have given unstinted support for my work and a few names, which I cannot forget, are Śṛī TG Rāmakrishnan (Ernakulam), Śṛī Unnikrishnan (AG's Office, Calicut), Anil Nair, Lekha and Anil Dhavan.

I was greatly inspired by Dr. N. Gopalkrishna of Pune who gave constant encouragement ever since 1994 and took great pains in getting me whatsoever study materials were required not only from Pune but even from abroad and Śṛī TKN Gopalasvami [ex-Director (exploration), ONGC], one of the great spiritual men that I had occasion to see. In the field of History of Science, last five years of my interaction with Dr. KV Śarma had been the most rewarding of my association with any individual in terms of the knowledge and wisdom I have gained. I have received immense help also from Śṛī. KK Vamanan Nampūtiri in pursuing the study of modern and Indian astronomy as well as in getting study materials. I am deeply indebted to my organization, ONGC, and the colleagues seniors and juniors at both Ahmedabad and Assam: S/Śṛī. SS Bakshi, Nilesh Jain, Rajesh Chandra, Jayaprakash Narayan and the staff of Logging section at Jorhat, Assam; After my joining at IRS, Ahmedabad I was greatly inspired by Śṛī. JM.Joshi (ex-GGM (IRS)), and my colleagues in the petrophysical laboratory: S/Śṛī. AV Sapkal, DC Tiwary, CL Chaudhary, AK Sharma, MS Rauetela and Dipak Mandal. Also I owe special thanks to S/Śṛī. Ramdeo (ex-GM), K. Nagendrudu (Dy.GM), B.Suryakumar and K.Murugan for the inspiration they have given under trying times. I have no words to express my thanks towards these individuals.

Lastly, I am to express my profound admiration of the Tāntric spirit of Brahmaśṛī Mithran Nampūtirippād, who had the esoteric talent to foresee my mission - emergence of the present work that provides a new foundation for Jyotiṣa – as early as on 27th November 1989. Since then Jupiter has made a round of the heavens taking me through many a

pitfalls and at last rewarding with the few insights which I have presented in this work. I am greatly indebted to the life-saving prophecies and affection that he has showered upon me. With reasoning I had many occasions that impelled me to uphold reservations about the validity of astrology but my experiences with him offered a far more sound conviction than reason in my quest for the truth.

As Max Plank had observed – "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it" – it is quite unlikely that the veterans engaged in the 'unscrupulous astrological business' or the hypocrite Ācāryas may accept the truth outlined in this book. Our society shall continue to be enslaved by the established notions till a new generation springs up with scientific thinking, free of vested interests. Until such time the truth has to be sustained by creative men engaged in the study of Jyotiṣa and Yoga-Āgama who shall be realizing the truth of Mūlādhāra Rāhu Śikhi Cakra in their day-to-day existence. If the present work does not offer such a verification it is deemed to be forgotten with the contempt it deserves…

12.10.2001
Kadapra

K. Chandra Hari

I

ANTIQUITY OF JYOTIḤŚĀSTRA

Agniḥ Devatā
Madhucchandass Ṛṣiḥ
Gāyatrī chandas

Ōṃ Agnimīḷe purōhitaṃ I Yajńasyādevamṛtvijaṃ I Hotāraṃ ratnadhātamaṃ II

"Ōṃ, I praise Agni, born of the ṛtus at the helm of the year like a priest who bestows gifts to all in a sacrifice".

"We should, therefore, follow reason and also sympathize with those who do not come to any sort of belief, following reason. For it is better that mankind should become atheist by following reason than blindly believe…on the authority of anybody. What we want is progress, development realization. No theories ever made men higher. No amount of books can help us to become purer. The only power is in realization and that lies in ourselves and comes from thinking. Let men think. A clod of earth never thinks; but it remains only a lump of earth. The glory of man is that he is a thinking being. It is the nature of man to think and therein he differs from animals. I believe in reason and follow reason having seen enough of the evils of authority, for I was born in a country where they have gone to the extreme of authority"

Svāmi Vivekānanda (Complete Works, Vol. II, p. 336)

I

ANTIQUITY OF JYOTIḤŚĀSTRA

1. Mystery of the beginning and 18 - Ācāryas

Jyotiḥśāstra is the ancient wisdom comprising of astronomy and astrology. While astronomy evolved in much the same way as other natural sciences in the known history of our species, astrology depicts a marked difference by its reliance still on the pre-historic foundations. The basic principles used for transliteration of the zodiacal coordinates in to the events of terrestrial life in a manner that defies commonsense – the logical spirit and scientific perception – of the age that we describe as 'modern' are generally believed to have emerged out of the irrational conjectures and symbolism of the primitive minds. If it is so, obviously astrology has only little scope to become a true science of the correlation between terrestrial and the planetary phenomena! The apostles of modern science have therefore discarded astrology as having no scientific foundation while according baptism to astronomy. In the words of Dr. M. N. Saha:

"From very early times and amongst widely separated communities, mystical importance was ascribed to the wandering of the planets. These mystical ideas took a very definite form in the shape of 'Planetary Astrology', which grew in Mesopotamia during the period 1300 B.C. to 800 B.C. This Planetary Astrology is to be distinguished from an older form of Astrology widely found in Vedic India, which centered mainly round the moon, and the lunar mansions, and to a lesser extent on the sun.... Planetary Astrology took the world by the storm after 300 B.C. and its influence was strongest during Middle Ages in Europe, till the rise of rationalism and modern science almost completely undermined this influence. But it still survives amongst credulous in the west....

What was the reason for the strong fascination which man has for astrology?

Mankind has always a psychological weakness for omina, i.e., some signs which can predict future events, good or bad.... The older form of omina were all apparently very crude compared to planetary omina which gradually emerged in Babylonian history from the time of Assyrian supremacy (ca. 1300 B.C.)... At first planetary astrology appear to have been confined to the states, and kings or powerful officials representing the state. But after the conquest of Babylon by the Persian conqueror Cyrus (538 B.C.), they appear to have been extended to private individuals. Thus came into existence 'Horoscopic Astrology'.... We are not interested in 'Horoscopic Astrology' at all, but wish only to remark that but for the stimulus provided by astrology, there would not have been that intense activity during ancient and (from about 500 B.C.) medieval times, for large

scale observations of the sun, the moon, and the planets, and compilation of tables of positions, which afforded the basis on which modern astronomy has been built up...." [(1)]

Dr.Saha's caricature of astronomical developments continues further and joins Alberuni in condemning astrology in the following words:

"The "astronomical science" as evolved by the Chaldean astronomers, is seen to be in reality the byproduct of the huge amount of astrological nonsense, a few pearls in a huge mass of dung, as Alberuni observed nearly ten centuries ago".

These are the perceptions typical of a modern scientist on the scientific worth as well as historicity of horoscopic astrology. For a better comprehension of the established notions on the Babylonian origin and development of astronomy and astrology we need a peep in to the ancient Mesopotamian chronology framed on the basis of archaeological evidences.

Mesopotamia had an urban civilization as early as 4000 BC while the early Egyptian and Minoan (Mycenaean) Greek civilizations had their beginnings around 3100 BC. The royal graves of Ur dated to 2600 BC testify the Sumerian occupation on an earlier date and these Sumerians produced the oldest known cuneiform scripts on tablets of clay. Sargon founded the Akkadian or Semitic Empire in 2370 BC and it prevailed for about 250 years. Babylon was only a small city in the great empire of Ur till the advent of Hammurabi [1792-1750 BC] and after the great rule of Hammurabi Babylon fell into the hands of barbarians called Kassites in 1508 BC. Assyrian domination all over the Middle East lasted for about 100 years from 745 BC to the fall of Assyria in 612 BC. Nebuchadrezzar who ruled over Egypt also, established second Babylonian or Chaldean Empire in 605 BC. The Chaldean Empire lasted up to the conquest of Babylon by Persians in 539 BC and the Persian dominance ended with the invasion by Alexander in 331 BC. After Alexander, Ptolemies ruled over Egypt and the near east from 305 BC to 30 BC. Against this chronology of Babylon the profile of astronomical development can be configured as:

- Astronomical observations and the use of astronomical omens for divination purposes since the time of proto-Sumerians of 4000 – 3000 BC.
- World's earliest written records – inscriptions on clay tablets – unearthed from early Sumerian city Uruk and the Elamite city of Susa contained evidences of the prevalence of sexagesimal and the decimal number systems: 3000 – 2000 BC.
- Old Babylonian period, the period since Hammurabi: The Twelve Constellations/ Zodiacal signs and planetary records emerged. Ptolemy, who lived in the second century AD, had claimed access to Babylonian eclipse records dating back to 747 BC. Earliest record of an eclipse traceable is 5th March 1223 BC over a clay tablet unearthed from Ugarit [35N37, 35E47].

- Horoscopic astrology developed in the Chaldean phase around 600 BC and the oldest available record of the horoscope is dated to April 29, 410 BC. According to traditional belief it was a Babylonian priest named Berossos – the founder of a school of astrology in the Greek coastal island of Cos around 340 BC - who introduced horoscopic astrology to the Greeks.

In contrast to this western profile the puranic lore and the epics Rāmāyaṇa and Mahābhārata of the Hindus are replete with details of horoscopic astrology, attached to a time frame irreconcilable with the modern sense of history. Further innumerable astronomical references are available in the Vedic literature belonging to the pre-historic past and the most fundamental treatise of Hindu astronomy authored by Mayāsura credit itself with an antiquity of 2160000 years before the beginning of Kaliyuga in 3102 BC. Hindu astrology, popularly known as 'Horā' is conceptually unique as well as different from the various schools of predictive sciences prevailing elsewhere and is deeply rooted in the antiquity claimed by the Purāṇas. For example, Kaśyapa speaks about the 'Ṛṣi-parampara' – the superhuman beings who brought forth and nurtured the supreme science of Jyotiṣa:

Sūrya Pitāmaho Vyāso Vasiṣṭof tri Parāśaraḥ
Kaśyapo Nārado Gārgo Marīcir-Manur-Aṅgiraḥ
Lomaśa, Pauliśacaiva Cyavano, Yavano, Bhṛgu
Śaunako aṣṭādaśāścaiva Jyotiḥśāstra pravartakāḥ

All these divine Sages belong to an untraceable antiquity, but their astrological lore could partially survive the millenniums to reach us today[1]. Modern orientalists have spurned all such treatises and Purāṇas (mythological nonsense according to Whitney) as spurious works of comparatively recent origin. As for example, Dr.M.N.Saha's words quoted above, which speculate a Babylonian origin around 500 BC are amply reflective of the modern Indian outlook on Horoscopic astrology. If it is so, what might be the historic

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[1] To quote Late.Sri.Sankar Balakrishna Dikshit:

"We know that the divine works on astrology extant at present are 'Gauri-jātaka' and 'Kālacakra-jātaka' and the 'non-human' or 'ārṣa' works (i.e., those compiled by Sages) are Parāśari, Jaimini sūtra and Bhṛgu samhitā. The Parāśari has two editions Bṛhat and Laghu. The most ancient of the existing 'man-made' work on astrology is the Bṛhatjātaka of Varāhamihira. At the end of the work, Varāha remarks...meaning, "Varāhamihira after studying the views of Sages, compiled this beautiful work on astrology". Elsewhere, Chapter 6 – verse 10, he also uses the word "Munigaditaṃ" meaning 'mentioned by Sages'. He has referred to Parāśara twice ...to Māṇḍavya in the chapter on 'Graha-gocara' in Bṛhatsamhitā. Similarly, Bhaṭotpala the commentator on Bṛhatjātaka has given quotations about astrology from the Gārgi, Bādarayaṇa, Yājñavalkya and Māṇḍavya works....". Dikshit also suggests the existence of the works of Sages such as Garga, Vasiṣṭa, Bharadvāja, Śaunaka, and Atri. Balabhadra who wrote in 1653 AD has quoted Kaśyapa, Nārada, Garga, Vasiṣṭa, Sūrya, Keśavārka, Yājñavalkya, Bādarāyaṇa, Satyācārya, Devakīrti, and Śukrācārya, Suka, Manu etc. In addition to these Sages there was Kauśika Viśvāmitra, Agastya and many others who has created the mysterious 'Nādis' available in different parts of our country.

phase in which the legendary Ācārya-parampara has evolved? If we take the words of Meghanad Saha (written for the Calendar Reform Committee appointed by the Government of India) seriously, the term 'Vedic Astrology' as being under use now across the globe is surely a misnomer. Most of those who hold the banner of Vedic astrology are either ignorant or unconcerned about its roots into antiquity and the absurdity of the term when placed against the established notions. Even the followers of Government of India's Citrapakṣa zodiac describe themselves as 'Vedic' astrologers in total contradiction to the historical perceptions* of its pro-genitor viz., the Calendar Reform Committee headed by Dr.M.N.Saha. To understand the irrational grounds of history over which Jyotiḥśāstra stands today we must ask ourselves a few pertinent questions:

1. In the known history of human beings, do our species ever had the sufficient intellectual caliber to discover the true science of correlation and symbolism between the terrestrial life and the planetary phenomena? If yes, what prevents our modern scientists from rediscovering the scientific rationale behind the symbolism of the zodiac and the mathematical constructs of astrology? Even while standing at the portals of the 21st century, why the scientists are incapable of comprehending the 'mechanism' responsible for the astrological phenomena? How can the irrational conjectures of primitive minds can have such sway over human minds as astrology is having when Man could transcend scores of other blind faiths successfully during the last few hundred years of its civilizational history?

2. If astrology evolved out of a synthesis of crude observational astronomy and archetypal imagination of the ancient people what scientific worth can it have? If we deny the existence of Kaśyapa, Kauśika, Vasiṣṭha, Parāśara etc., who have given rise to the glorious scientific tradition that we see in the Vedāṅgas and Upavedas such as Āyurveda, Gandharvaveda, Sthāpathyaveda etc., what heritage do we have to be proud of and what credibility shall remain for the sanctity and 'Ārṣa' origin of these disciplines – especially for Jyotiṣa that is the very foundation or Vedacakṣu and hence indispensable for the Hindu way of life?

3. Even many of the well-known scholars and astrologers having absolute faith in astrology tend to believe that Hindu astrology evolved out of the AD 5th Century astronomy as can be seen in the works of Varāhamihira. Have they used their brain diligently to examine the following aspects:

   Do the works of Āryabhaṭa, Varāhamihira or Brahmagupta contain an astronomically correct definition of the sidereal zodiac or 'Rāśicakra'? Have they really spoken about a sidereal zodiac in the sense that we know today? If the answer is 'no', how could the concept of a sidereal zodiac emerge in distant antiquity and what is the basis of our sticking on to a fictitious non-entity?

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*According to the Calendar Reform Committee headed by Dr.M.N.Saha Indian astronomy had its epochal beginning in AD 285 when the autumnal equinox coincided with the Citra star (α-Virginis or Spica). We shall refer to this matter in detail subsequently.

4. An Ephemeris publisher of Delhi has placed the entire gamut of Vedic and Siddhāntic astronomical references before the public to illustrate that nothing sort of a sidereal zodiac is apparent in the Śrutis, Smṛtis and their ancillary literature. No one has dared to step in so far to show him a scriptural or historical basis for the so called 'Vedic' astrology even though years have passed since the first appearance of his fierce challenge and the situation inspires me to ask:

   While the tropical zodiac is unique with the venal equinox as the zero point, we have today a number of sidereal zodiacs. Is this not a reflection of an inherent uncertainty in the scriptures or our inability to identify the truth or the original one?

5. What is the sanctity of a sidereal zodiac over the tropical one? How can both sidereal and tropical schools of astrology be correct?

   We need to deliberate a little detail on this aspect: Zodiac is a circle. Geometrically or mathematically every point of a circle is on a par with the other to be considered as the zero point. On what basis is then a particular point is chosen as the zero or initial point? In other words, what is the physical rationale over which a zodiac is defined?

   The tropicalists may readily jump off their seats to proclaim that they have the answer as well as right choice - their zero is astronomical, vernal equinox being the intersection of the ecliptic and the equator which marks the onset of spring in the northern hemisphere and the ancient Sages began their calendar from this reference. But when we consider the southern hemisphere spring begins exactly on the opposite point, the autumnal equinox. Tropicalists may still erect the horoscope with the vernal equinox as the zero point. Ecliptic cuts the equator at two points known as the equinoxes and astronomically they have equal rights to be considered as the zero reference. Based on astronomical phenomena we can have many other choices as well like say, the solstices, and scriptural evidences can be provided for their role as initial points of calendars. What makes the vernal equinox significant as the reference in the horoscopic delineation of destiny? None are able to give an answer.

6. As many of the 'Ācāryas' proclaim, if the origin of astrology can be traced to the Vedas, what is the Vedic zero point of the stellar zodiac? Or if the astrology is of Babylonian origin, what do their chronicles speak?

7. Is their anything more funny and idiosyncratic than the application of Parāśara Horā over the zodiacs fathered by X, Y, or Z, in the 20th century?

It is therefore apparent from the above discussion that the citadel of astrology cannot be re-created over rational grounds without the correct historical perspective on its origin as well as development. For raising the Vedic astrology to its pristine glory, we must be able to answer all the above questions satisfactorily.

2. Origin of the Babylonian Zodiac

The name Zodiac is derived from the Greek term *zoidiakos*, which means a circle of animals. Zodiac by definition is the belt of the heavens including all apparent positions of the sun, moon and planets as known to ancient astronomers and divided into twelve equal parts known as the signs of the zodiac. As regards the origin of this conception of a 'Heavenly Circle of the Signs or Animals' many theories have come to exist but universally the trend is to credit the ancient Sumerians and Babylonians with this invention. O. Neugebauer has assigned 700 BC for the beginning of Mesopotamian astronomy. As regards the pre-Seleucid phase Neugebauer observes:

"We know only very little about the prehistory of this Babylonian astronomy. In the extant texts from the Hellenistic period almost all methods appear fully developed. On the other hand it is virtually certain that they did not exist at the end of the Assyrian period. Thus one must assume a rather rapid development during the fourth or fifth century B.C.The same two centuries witness also the first steps in Greek astronomy. The beginning is made by the "School" of Meton and Euctemon (around 430 BC) with observations concerning the length of the solar year and with the formulation of the "Metonic" 19-year cycle which may or may not be independent of the contemporary Mesopotamian discovery of the same cycle..."

Also in the context of the 'Babylonian influence' over the world of astronomy we can find:

"The mere fact itself of Babylonian influences on Hellenistic astronomy is obvious. It suffices to mention the all-pervading use of the sexagesimal system, e.g. in the reckoning of time or in the division of the circle, the presence of Babylonian parameters in Hipparchus' lunar theory, or the frequent use of Babylonian arithmetical patterns in various fields, e.g. mathematical geography, gnomonics, etc. It is much more difficult, however, to determine with reasonable accuracy the time of transmission or the mode of contact and to evaluate correctly the degree and importance of the influence of Babylonian astronomy on the nascent Greek science. Without insight into specific technical details one can easily over emphasize influences, which in fact do not require more than the transmission of a few basic concepts. One has to face still greater difficulties in the evaluation of secondary transmissions, e.g. into India where the problem of Hellenistic and Iranian intermediaries may seem unsolvable".

These views of O. Neugebauer are representative of the general perceptions prevailing on the history of astronomy as well as the sexagesimal system. Further according to O.Neugebauer the change from the older irregular zodiacal constellations to the familiar coordinates of longitudes in the fixed zodiac of 30° signs took place around 500 BC in the Achaemenid period. This fixed zodiac of constellations differed from the modern tropical zodiac in the basic conception of the initial point and Neugebauer gives the following description in contrast:

"The reckoning in the Almagest of the 360 degrees of longitude, beginning at the vernal equinox, called Aries 0°, is of course, related to the discovery of precession and the resulting decision to define the solar "year" as the tropical year. In accepting this definition, one completely severs all relations between the zodiacal signs determining longitudes and the zodiacal constellations. In Babylonian astronomy no distinction was made between tropical and sidereal year. Longitudes were not counted from the vernal point but from the sidereally fixed endpoints of the zodiacal signs, i.e. in terms of signs and degrees from 0 to 30, not in degrees from 0 to 360. In this fixed ecliptic the equinoxes and solstices were located at certain points, in "System A" at the 10th degree, in "System B" at the 8th degree of their respective signs..."

In the context of our discussion it is necessary to investigate the basis of these two systems differing by 2° as regards the location of the vernal point.

Vernal point in the 8th degree

O. Neugebauer has quoted several instances of the appearances of this zodiac among Greek and Roman sources. Star catalogues of the Seleucid era also reflect the fall of vernal equinox in the 8th degree. Neither Neugebauer nor any other authority could so far explain the rationale behind this choice of the initial point. It is therefore apparent that no explicit mention of the rationale of zero point or of the fiducial star could be found in the clay tablets unearthed so far. The norm remained in use even during the first five centuries of the Christian era among the Greeks and Romans.

Vernal point at Aries 10°

Certain authorities have referred to this tradition as arising from the time of Meton, who is said to have inaugurated the 19-year cycle in Athens on (–) 431 June 27. So the possibility that Meton might have borrowed the Zodiac and the 19-year cycle from Babylon cannot be ruled out.

The earliest of the Babylonian tradition places the vernal equinox at Aries 15° and accordingly the epoch belongs to 9th century BC – the period of Assyrian empire at Nineveh. Even though the 8° norm became popular with the different authors of the outer world (as quoted by Neugebauer), the sidereal initial point continued to prevail among the astrologers of Greece. In the words of Neugebauer:

"If we assume that around 300 BC the vernal point was given a sidereal longitude (i.e. reckoned with respect to a certain fixed star) of about 8° or 10° then its sidereal longitude around the beginning of our era would be, because of precession, in the neighborhood of 5°. This is in fact the order of magnitude of the deviation between modern (i.e. tropical) longitudes and longitudes given in Greek horoscopes. In other words the astrological

literature of the Hellenistic – Roman period still preserves the norm of Babylonian astronomy."

The cuneiform observational records of the above kind was used by Cyril Fagan in framing his zodiac which uses Aldebaran as fiducial at 45^0, i.e., the midpoint of the zodiacal sign Taurus. The Zodiac that we find reflected in the above discussion is obviously sidereal and the conception belongs roughly to an antiquity of 500 BC even though Fagan has spoken of Egypt at the time of Pharaohs as the cradle of his zodiac. Amalgamation of the Babylonian and Egyptian wisdom is generally regarded as to have taken place after the Persian conquest of Egypt in 539 BC or perhaps more seriously during the period of Alexander and the Ptolemies.

Established scholars such as Otto Neugebauer are hesitant to recognize the existence of a precisely defined Zodiac in the above norms and has expressed reservations in this regard:

"Babylonian "longitudes" are always reckoned by zodiacal signs ♈, ♉ etc., but the cardinal points of the solar year are not located at the zero points of their respective signs, but at 10^0 in System A, at 8° in System B. One must not ascribe to this norm any deeper astronomical significance. The zodiacal signs originated, of course, from irregular constellations... When finally the irregular configurations were replaced by real ecliptic coordinates in signs of equal 30° length the sign "Aries" obtained by some accidental compromise such a position within the constellation Aries that the vernal equinox took place when the Sun was at the 10^{th}, respectively 8^{th} degree of the sign. We do not know what chronological relation existed between these two norms and what caused the difference. We have no evidence from Babylonian sources about a recognition of precession and we have no reason to assume that the difference of zero points in system A and B had anything to do with it knowingly or unknowingly..."

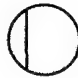
Contrary to these observations the stellar longitudes of the Seleucid era (corresponding to the "8^{th} degree norm" of 312 BC) as well as the data of Kugler and P. Huber quoted by O. Neugebauer point towards a precise definition of the zodiac immune to the precession of the equinoxes in existence. According to Kugler, in 121 BC Aries 0° had a tropical longitude of (–) $4^{\circ}.6$ while P. Huber showed that in about 100 BC, $\lambda_{Bab} - \lambda_{modern}$ had the limits of $4^{\circ}.467 \pm 20'$. This variation across 10^0, 8^0 and $4^0.5$ for the position of the vernal equinox can be accounted for only by precession over a fixed zodiac. Modern Astrology has failed to inherit the Chaldean notions on the initial point from which the circle was conceived and it was Hipparchus who brought in the concept of vernal equinox as the zero point to astronomy. Undoubtedly it was the Babylonian experience of precession on the fixed stellar zodiac that enabled Hipparchus to postulate a displacement of the solsticial and equinoctial points around 120 BC.

The developments of the Middle East in astronomy and astrology are believed to have transmitted to India through Greek and Persian contacts. To quote David Pingree:

"The relative seclusion from the West which the Aryans had enjoyed in northern India for centuries after their invasions was broken shortly before 513 BC when Darius the Great conquered the Indus Valley. In the ensuing six centuries, save for a century and a half century under the Mauryan emperors, North India was subjected to the successive incursions of the Greeks, the Sakas, the Pahlavas and the Kusanas. An important aspect of this turbulent period was the opportunity it afforded of contact between the intellectuals of the West and India. This opportunity was not missed.

In the period from 500 to about 230 BC – under the Achemenid occupation and during the reigns of Candragupta Maurya, Bindusara and Asoka – Indian astronomy was introduced for the first time to some reasonable Babylonian methods, and astrologers were led to show an interest in more significant phenomena than the naksatras...."

This is the evolutionary background of the so-called Vedic zodiac prevalent in modern India, having no roots beyond 500 BC as per the established notions. The father of the Tropical Zodiac shall obviously be Hipparchus while the available evidence suggests a Chaldean origin of Sidereal Zodiac with some untraceable astronomical /physical rationale. Neither of these conceptions adds any credence to the astrological wisdom, as both do not offer any reason for the respective longitudes to be indicative of human destiny. Further, in the Age that we describe as 'modern', practitioners of both the systems are aplenty who denounce each other or for convenience sake describe the choice of a zodiac as a matter of faith in the divination process. It is therefore apparent that astrology cannot be placed in a true historical or scientific perspective with the available information on its origin and development. To accomplish this task we need a deep excursion into the saga of Indian civilization.



II

HISTORY OF INDIAN CIVILIZATION

"The borders between prehistory and history are extremely vague and differ chronologically from place to place. Moreover there is no immediate change from prehistory to history but rather a long transitional period, when both material and written source form the raw data of archaeology. For this period the word proto-history is often used. The only source for knowledge of humankind during the prehistoric period of roughly three million years is archaeology – the material remains"

"The field of reason, or of the conscious workings of the mind, is narrow and limited. There is a little circle within which human reason must move. It cannot go beyond. Every attempt to go beyond is impossible, yet it is beyond this circle of reason that there lies all that humanity holds most dear. All these questions, whether there is an immortal soul, whether there is a God, whether there is any supreme intelligence guiding this universe or not, are beyond the field of reason. Reason can never answer these questions. What does reason say? It says 'I am an agnostic; I do not know whether yea or nay". Yet these questions are so important to us. Without a proper answer to them, human life will be purposeless. All our ethical theories, all our moral attitudes, all that is good and great in human nature, have been moulded upon answers that have come from beyond the circle.'

Svāmi Vivekānanda (Complete Works, Vol. I, 11th edition, pp. 181)

II

HISTORY OF INDIAN CIVILIZATION

1. Scholarly Views On Ancient Indian History

Nothing can be more interesting and illustrative of the historian's process than the wide spectrum of views expressed on the antiquity of Vedic civilization and on the dates of the events mentioned in the epics Rāmāyaṇa and Mahābhārata. A panoramic view of the conclusions from the various quarters of historical research are provided below:

(a) Romila Thapar in her much acclaimed 'classic history of ancient India'

" Our earliest literary source is the Ṛgveda, parts of which were originally composed prior 1000 B.C. The remaining Vedic literature – the Sama, Yajur, and Atharva Vedas – is also of later date.... The two epics, the 'Rāmāyaṇa' and the 'Mahābhārata' are connected with events which took place between c.1000 and 700 B.C., but as the versions which survive date from the first half of the first millennium A.D., they too can hardly be regarded as authentic sources for the study of the period to which they pertain. Incidents from the epic can be accepted as historically valid if supporting evidence can be found to bear them out". [1]

On a footnote the author goes on to suggest that the excavations at Hastinapura are indicative of it being washed away by the flooding of Ganges in 800 BC and a mention of this incident is available in the Puranas. See further the enlightening account given of the Mahābhārata and Rāmāyaṇa:

"Originally the Mahābhārata may have been the description of a local feud, but it caught the imagination of the bards and in its final form we find all the tribes and peoples of the sub-continent participating in the battle. Its composition is traditionally ascribed to a brahman poet, Vyāsa, but it is not the work of a single person.... The Rāmāyaṇa is shorter than the Mahābhārata and with fewer interpolations. The original version is attributed to the poet Vālmīki. The events described in the Rāmāyaṇa occurred somewhat later, since the scene is set further east than that of the Mahābhārata, in eastern Uttar Pradesh.... The description of Rāma crossing the peninsula and conquering Ceylon is clearly a representation of Aryan penetration...." [1]

Author goes on to describe Rāma and Rāvaṇa in terms of the 'agriculturists of the Ganges valley' and the 'more primitive hunting and food gathering societies of the Vindhyā region' and finally dates the events to 800 BC or a bit earlier based on a scale of

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[1] Romila Thapar, A History Of Ancient India – Volume I, Penguin Books, New Delhi-19, pp.31-32

antiquity versus depth of Aryan invasion. Note the Marxian flavor and the process by which history is articulated more excellently than fiction writers.

(b) A.L.Basham [2]

"No real synchronisms are contained in the Ṛgveda itself, to give us any certain information on the date of its composition. Some authorities in the past claimed an exceedingly early date for it, on the basis of tradition and ambiguous astronomical references in the hymns themselves – it was even believed by one very respected Indian scholar that it was as old as 6000 B.C. The discovery of the Indus cities, which have nothing in common with the culture described in the Vedas and are evidently pre-Vedic, proves that the hymns cannot have been composed before the end of Harappā. The great development in culture, religion and language which is evident in the later Vedic literature shows that long period must have elapsed between the time of the composition of the last hymns of the Ṛgveda and the days of the Budha - perhaps as much as 500 years. It is therefore probable that most of the Ṛgveda was composed between 1500 and 1000 B.C., though the composition of some of the most recent hymns and the collation of the whole collection may have taken place a century or two later".

(c) Balagangadhara Tilak [3]

"The high antiquity of the Egyptian civilization is now generally admitted. But scholars still hesitate to place the commencement of the Vedic civilization earlier than 2400 B.C. I have endeavored to show in the following pages that the traditions recorded in the Ṛgveda unmistakably point to a period not later than 4000 B.C., when the vernal equinox was in Orion, or, in other words, when the Dog-star (or the Dog as we have it in the Ṛgveda) commenced the equinoctial year. Many of the Vedic texts and legends quoted in support of this conclusion, have been cited in this connection and also rationally and intelligently explained for the first time, thus throwing a considerable light on the legends and rites in later Sanskrit works. I have further tried to show how these legends are strikingly corroborated by the legends and traditions of Iran and Greece.... Some scholars may doubt the possibility of deriving so important and far reaching conclusions from the data furnished by the hymns of the Ṛgveda, and some may think that I am taking the antiquity of the Vedas too far back. But fears like this are out of place in a historical or scientific inquiry, the sole object of which should be to search for and find out the truth....I have omitted to mention in the essay that a few native scholars have tried to ascertain the date of the Mahābhārata, and the Rāmāyaṇa from certain positions of the sun, the moon and the planets given in those works. For instance, the horoscope of Rāma and the positions of the planets at the time of the great civil war, as found in Mahābhārata, are said to point to a period of 5000 or 6000 B.C., and it is contended that the Vedas which preceded these works must be older still. Bentley relying on the same data has calculated 961 B.C., as the exact date of Rāma's birth. This will show how unsafe it is to act upon calculations based upon such loose statements. Sometimes the accounts in the Puranas

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[2] A.L.Basham, The Wonder That Was India, Rupa & Co., Calcutta-73, p.31

[3] B.G.Tilak, The Orion, Or Researches Into The Antiquity of The Vedas, 7th edition, Tilak Brothers, Pune-30, Preface 2nd Paragraph.

are themselves conflicting.... I have therefore avoided all such debatable and doubtful points by confining myself solely to the Vedic works, about the genuineness of which there can be no doubt and using the Purāṇic accounts only to corroborate the results deduced from the Vedic texts..."

When we contrast the accounts of Basham and Tilak it is apparent that the 'one very respected Indian scholar' referred to by Basham is certainly Tilak himself and in the aftermath of the discovery of Indus civilization the mainstream historians like Basham had enough grounds to reject the antiquity conceived by Tilak for the Vedas. Ever since the days of early European scholars the antiquity of Indian civilization had an aura of suspicion around it contributed by conflicting theses on the historicity and chronological content of the Vedic hymns. The archaeological discovery of Indus valley civilization, contrary to what we may expect generally, only increased the complexity and confusion because of the prejudiced western scholars and the script that defied attempts of decipherment. Relying exclusively on the incomplete archaeological information and its misinterpretation, the antiquity deciphered out of the hymns by scholars like H.Jacobi and B.G.Tilak got credited to the so called Dravidians of Harappā at the cost of Vedic Ṛṣis by historians like D.P.Chattopadhyaya. The ensuing period witnessed a proliferation of speculative theories on the history of India and it's Vedic past woven around the theme of "Aryan Invasion".

(d) D.P.Chattopdhyaya [4]

"Though some of the prominent scholars like Valle Poussin, Barth and Winternitz felt that it will be wrong to ignore "Jacobi's great chronological argument" the majority of Vedic scholars wanted to reject this as just absurd. Not that the astronomical data – and these as pointers to much antiquity - were necessarily questioned. What was questioned was the argument that since such data are found recorded in the Vedic literature, these are to be taken as indicative of the date of the literature itself. What is ignored is the possibility that the date of observation of certain phenomena is not necessarily the same as that of their codification, that the tradition of certain facts of observation may come down from a hoary antiquity though only to be used in codified form at a much later period by people with scanty enthusiasm for direct observation."

The sum and substance of the distorted history he had written is that the Vedic priests were *'on the whole social parasites subsisting only on the dakṣiṇa-s'* and *'certain scraps of knowledge about the celestial phenomena forming part of ancient astronomical lore could somehow come down to them and could be effectively used by them to add grandeur to their sacrificial cults'* and as such they grafted the astronomical information received from Harappā in their own literature. It must be noted here that this historian had not a page of literary information about the astronomy of Harappans and the vast records of the Vedas were available with him but still he chose to credit all the astronomical achievements to the so called 'Dravidians' of Harappa. See, how detrimental can be the

[4] D.P.Chattopadhyaya, History of Science and Technology in Ancient India-the Beginnings, Firma KLM Pvt.Ltd. Calcutta-12, pp.261.

bias and the role of subjectivity in shaping history. The ruins of Indus valley have been artificially made to speak of a history that these scholars had in their minds!

This absurd history [(4)] was written as a project sponsored by National Institute of Science and Technology & Development Studies (A constituent establishment of the Council of Scientific and Industrial Research) and contains the most unscrupulously drafted and perverted account of the Vedic civilization. Neither the authors nor the authorities who have allowed expenditure from the exchequer have taken care to see that the dogmatic prejudices are kept at bay in the formulation of history. It is unfortunate that no cognizance was given to the following words of R.C.Majumdar, the doyen of Indian historians: [5]

"*There are no doubt exceptions, but one cannot deny, or overlook, the broad fact that Indian history has suffered from an instinct to read the present in to the past.*

The opposite danger of reading the past into the present has been no less a potential factor in distorting the history of India.... In either case it is a wrong interpretation of Indian history, and what is worse, ***such interpretation is often devised as an instrument for consecrating all deep- seated prejudices***[*].

The student of Indian history must avoid these pitfalls and follow the method of scientific research. Our aim should be the discovery of the truth, and nothing but the truth, and in order to attain this goal we must apply our minds fearlessly and without prejudice and preconceptions to the study of all available evidence. We should properly sift these data by all rational methods, handle them in the spirit of a judge rather than an advocate, and formulate our conclusions only as far as they permit us to do so. We may not achieve definite results in many cases, and final and decisive conclusions would probably be few and far between. ***But it is better to plead ignorance, express doubts and put forward alternative possibilities rather than definitely uphold a view on meager and insufficient grounds...."*** (Emphasis mine)

Unfortunately, Indian history has got more 'advocate'-authors than judges and the prevailing notions we tend to accept as ascertained facts were not created on the above lines of Majumdar. Early European scholars who have rendered the big corpus of Vedic literature into English and who have created the established notions were not only strangers to this land and its profound traditions but also were possessed of cultural and colonial biases and consequently they ended up in misinterpreting things that failed their comprehension[*].

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[5] R.C.Majumdar, The Vedic Age, Bharatiya Vidya Bhavan, Mumbai, p.40

[*] Debiprasad Chattopdhyaya's work amply illustrates this fact.

[*] I could find a very interesting depiction of the situation in an article by Visvanatha Mehta:

"For a proper understanding of any treatise on any subject, first of all it is essential to familiarize with the specific terminology of the subject and the special technique of expression used therein. Without that we shall make a hell of it, presenting an interpretation that will have no head or tail. For example, let a layman unfamiliar with the relevant terminology read a book on biochemistry. Finding

(e) Historicity of the Purāṇas

'A Concise History of Science in India' published by the Indian National Science Academy contains the following account:

"Colebrooke, Wilson and other scholars dated the Puranas between the ninth and thirteenth century A.D. On the basis of Kautilya's reference to the Purāṇa, Smith thought that this type of literature had already become authoritative in the fourth century B.C. In his voluminous studies on the Purāṇas, Hazra attempted to fix an approximate date of the Dharmaśāstra portions of the Purāṇas and suggested for the Mārkaṇḍeya, the Vāyu, the Brahmāṇḍa, the Viṣṇu, the Matsya and the Bhāgavata a dating ranging from the third to seventh century A.D. The Bhaviṣya may be dated from c. A.D.500 onwards, the Agni c. A.D.800, the Garuda c. A.D.900...."

This is not surprising if we know that the Bhārata war might have taken place between 850 BC and 650 BC and that the 'compilation' of Mahābhārata was completed around 400 AD. Historians have the license to concoct and tell us that - Chanakya has seen neither the Mahābhārata nor the Purāṇas, the works of Kāḷidāsa are anterior to the extent version of Mahābhārata, Rāmāyaṇa and the Purāṇas, the nomadic Aryan tribes who descended on the Indian sub-continent from central Asia had a sophisticated language and part of the Vedas with them, the Dravidian settlements around the Indus flourished with a literary record that could not be deciphered and the ruins of subsequent Aryan settlements are yet to be located archaeologically ...etc. Since the beginning of the last century historians have created innumerable propositions on almost every aspect of Indian chronology. The process involved maneuvering to such an extent that the real facts got obliterated and the end product is a manifold of distortion.

(f) Kota Venkatachalam [6]

"The Orientalists from Europe have been persistently dinning into the ears of their credulous Indian disciples that for the purpose of reconstructing the history of ancient India, Puranic literature is altogether useless and that the reliance should be placed solely on inscriptions, coins, buildings and accounts of the foreign travelers who visited India in those times. Strictly speaking the ancient history of no western country is based primarily on such evidence.... ***In fact these very orientalists could not produce any inscriptions, coins, buildings or any genuine historical evidence for their theory of***

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a statement therein that "traveling through blood streams minerals reach their destination", he might understand that there must have been in existence somewhere on the earth "rivers flowing with blood" through which "ores extracted from mines had to be transported to great distances". Some other fellow, on being confronted with such an interpretation of the text, might find that nonsensical and reject the whole treatise as unworthy of study. Exactly the same happened in the case of our ancient texts especially of the Vedas and Puranas as interpreted by highly prejudiced western scholars totally unfamiliar with the specialized Sanskrit terminology of various disciplines ..."

[6] K.Venkatachalam, The Plot in Indian Chronology.

the contemporaneity of Alexander or Selucus with Candragupta Mourya. Yet, they made it the foundation...."

Emphasis given above is mine and here we have a hundred percent true statement that beckons us to the portals of the great conflicts in Indian chronology - towards the fragile grounds over which the history of India was articulated by F. Max Muller and Sir. William Jones. Presumed coronation of Candragupta Maurya around 320 BC has been taken as the sheet anchor of Indian chronology relying just on the resemblance of his name with Sandrocottus of the Greek records.

(g) In the words of Max Muller

"...although we look in vain in the literature of Brahmanas and Buddhists for any allusion of Alexander's conquest and although it is impossible to identify any of the historical events, related by Alexander's companions with the historical traditions of India, the name of Sandrocottus or Sandrocryptus, the Sanskrit Candragupta is there to form a connecting link between the history of the East and West".

M.Trover did dispute the identification of Candragupta Maurya with Sandrocottus as early as in 1859 AD in his introduction to the translation of Kalhana's Rajatarangini and in later years certain authors have gone to the extend of alleging a conspiracy by Warren Hastings and Sir. William Jones for protecting the Christian date of creation viz., 23rd October 4004 BC. This is not altogether untenable or exaggeration on considering the psychology of Christian crusaders like Max Muller as we can find reflected in the following words:

(1) F.Max Muller [7]

• In a letter addressed to his wife (1866 AD):

" This edition of mine and the translations of the Vedas will hereafter tell to a great extent on the fate of India.... It is the root of their religion and to show them what the root is, I feel sure, is the only way of uprooting all that has sprung from it during the last three thousand years."

•• Letter dated 16 December 1868 to the Duke of Argyl [8]

"The ancient religion of India is doomed and if Christianity does not step in, whose fault will it be?"

(2) Sir M. Monier-Williams, Boden Professor of Sanskrit, Oxford [9]

"Some of my critics and a few candid friends have expressed surprise that I should have devoted so much of my long tenure of the Boden Professorship to the dry, dreary and thankless drudgery of writing Dictionaries and Grammars ...In explanation I must draw

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[7] Life and Letters of F. Max Muller, Volume-1, Chapter XV, p.346

[8] Ibid, Chapter XVI, p.378

[9] Sir M.Monier-Williams, Sanskrit – English Dictionary, Munshiram Manoharlal Publishers, 54 Rani Jhansi road, New Delhi-55, p.9 of Preface.

attention to the fact that I am only the second occupant of the Boden chair, and that its Founder, Colonel Boden, stated most explicitly in his will (dated August 15, 1811) that the special object of his munificent bequest was to promote the translation of the scriptures into Sanskrit, so as 'to enable his countrymen to proceed in the conversion of the natives of India to the Christian religion'..."

Further in 'Modern India and the Indians', he cries out in full display of his missionary zeal:

"Brahmanism, therefore must die out. In point of fact, false ideas on the most ordinary scientific subjects are so mixed up with its doctrines that the commonest education – the simplest lessons in geography – with the aid of Christianity must invariably in the end sap its foundations...When the walls of the mighty fortress of Brahmanism are encircled, undermined, and finally stormed by the soldiers of the cross, the victory of Christianity must be signal and complete".

Human psyche, the horizons of our thinking and commonsense invariably confine itself to self-drawn static boundaries until it is compelled by some new found wisdom to review, revise and expand the old limits to pave the way for a new set of conceptions. Swami Vivekananda did illustrate this aspect in his Chicago address by citing the story of a "Kūpa-maṇḍūk" (frog, born and brought up inside a well configuring the vastness of the sea by its leaps across the well). Exactly the same happened with the evangelic coterie that arrived in India in the 18th century with a limited conception of historic time derived from the Bible. It is a well known fact that the modern scientific age began in Europe with a conception of historical time woven around the 17th century calculation of Archbishop Ussher that the world was only 5650* years old. Obviously, they had a mind-set or scale of antique time calibrated over the shallow historic interval of just 5650 years while the Indians were speaking in terms of Millions or even greater. Even in the absence of racial or religious prejudice depths of Indian antiquity would have undergone contraction in their minds and given a choice they would have preferred only the posterior dates to fix the Indian chronology. Then what to speak of people who had the missionary spirit to uphold the history of humanity deciphered out of the Bible! Moreover India had no references to offer to serve the purpose of a crosscheck in the post puranic phase of our history.

(g) Francis Watson

The situation that confronted William Jones and others is best described by Francis Watson:[10]

"The task of bringing definition to Indian antiquity had begun in almost complete darkness, with Alexander the Great's penetration to the Indus in 326 BC as the only datable event. Before the Arabic and Persian chronicles of the great Moghuls, and of the Muslim sultans who preceded them, history did not exist. In the abundance of Sanskrit learning, poetry and speculation there was no apparent place for it (though Kalhaṇa's twelfth - century history of Kashmir is often cited as an exception). The very

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* In 1654, John Lightfoot precisely determined the biblical moment of creation to be on 26th October 4004 BC, 0900 hours at Mesopotamia.

[10] Francis Watson, A Concise History of India, P.18

name of Ashoka, the greatest of India's ancient rulers had been forgotten, his inscriptions unread until in 1838 James Prinsep, an official of the Calcutta Mint found the key that unlocked the Brahmi and Kharoshti scripts and from recovered coinage much of the ancient chronology".

(h) R.C. Majumdar [11]

"The absence of any regular historical chronicle is the leading feature of this (ancient) period. When we consider the vast mass of contemporary literature and its extremely wide range, the almost utter lack of historical texts certainly appears as a somewhat strange phenomenon. Some people are, therefore, inclined to believe that such literature did exist, and explain its absence by a theory of wholesale destruction. It must be regarded, however, as extremely singular that the agencies of destruction should have singled out this particular branch of literature as their special target. But the strongest argument against the supposed existence of regular historical literature is the absence of any reference to historical texts. We have, therefore, to admit that the literary genius of India, so fertile and active in almost all conceivable branches of study was not applied to chronicling the records of kings and the rise and fall of states and nations. It is difficult to give a rational explanation of this deficiency, but the fact admits of no doubt.

The deficiency is all the more strange as there are indications that the ancient Indians did not lack in historical sense. This is proved by the carefully preserved lists of teachers in various Vedic texts, as well as in writings of the Buddhists, Jains and other religious sects...Even so late as the seventh century A.D. Hiuen Tsang noticed that each province in India had its own official for maintaining written records in which were mentioned good and evil events ...We may thus presume that neither historical sense nor historical material was altogether wanting in ancient India. What was lacking was either the enthusiasm or the ability to weave the scattered raw material into a critical text with a proper literary setting which the people would not willingly let die...Whatever may be the reason, the fact remains that the only concrete result of historical study in the most ancient period is to be found in long lists of kings preserved in the Puranas and the epics. These lists profess to trace the unbroken royal lines from the first human king that ruled down to about the third or fourth century A.D. The earlier part of them is obviously mythical, and the last part is undoubtedly historical; but it is a moot point to decide where the myth ends and reliable tradition begins."

We have in the above the salient features of 'Ancient Indian History' in the words of some of the best known names in the field. We have traveled across a great span of antique time almost devoid of any perceptible milestones that will enable us to draw some definite conclusions on the antiquity of Rgveda vis-à-vis the Indus valley civilization or on the date of the so called 'Aryan Invasion' or on the profile of the latter phase of antiquity beginning with Buddha and reaching up to the days of the Greek conquest over the Indus. Apparently the edifice of history has been constructed over invalid conjectures conceptually as well as chronologically. Conceptually 'Aryan invasion' played great mischief ever since the days of Max Muller by rendering an obliquity to the vision of the

[11] PP.47-48

people to construe everything including the Vedic hymns in the light of an imaginary non-existent Arya-Dravida conflict. Chronology on the other hand has had to conform to the Westerner's comprehension of India's Purāṇic past which was fraught with inconsistencies of no mean order. We shall examine both these aspects separately in detail.

2. Indus Valley Civilization

(a) Francis Watson provides a concise account reflective of certain distinctive characteristics: [12]

"The civic sophistication sets the Indus civilization apart from its great contemporaries in Sumer and Akkad and Middle Kingdom Egypt. Its written language, which might dispel some of the mystery remains un-deciphered and has survived only in brief seal inscriptions apparently concerned with property or commerce. There seem to be no religious dedications, no names of rulers and so far no dynastic tombs to shed light on a hierarchical system. The terracotta seals, of type distinct from the Sumerian, are at once enigmatic and suggestive in the frequently consummate quality of their engraved images and in the subjects depicted, which include animals such as elephant, tiger, rhinoceros and the Indian humped and dewlapped bull – as well as mythical beasts, emblems and figures. A horned deity depicted on some of the seals, seated in yogic posture with erect phallus and accompanied by wild animals has been seen as an early prototype of the Hindu god Śiva. The numerous small clay figurines of an earth -goddess primitive by contrast with the seal engravings, point to a popular fertility cult; but the absence of monuments religious or secular, is singular...There is enough that is unique and indigenous about Harappa and Mohenjo-Daro to leave the question of influence from or upon the Sumerian culture an open one...."

(b) A.D.Pusalker on the authorship of Indus Valley civilization [13]

"The only definite material available with regard to the authorship of the Indus Valley civilization is the human skeletons and skulls found among the ruins. As mentioned above, these show that the population of Mohenjo-daro was heterogeneous and comprised at least four different racial types, viz., Proto-Australoid, Mediterranean, Alpinoid, and Mongoloid. The Mohenjo-daro population is, however, generally believed to have mainly consisted of the Mediterranean type, which has been described before (ante, p.145 ff). The craniological evidence speaks not only of the diverse racial elements, but also of free racial mixture...

Sir John Marshall has compared the Vedic civilization with that of the Indus Valley and has found that they are quite distinct; and as the entry of the Aryans into India, according to his view of the date of the Ṛgveda is subsequent to 1500 B.C., more than a thousand years after the last vestige of the Indus Valley civilization disappeared, he cannot think of the Aryans in connection with the Indus Valley civilization.

[12] A Concise History of India, P.26

[13] The Vedic Age, Bharatiya Vidya Bhavan, Mumbai, 1996, PP. 196-198.

Now the presumed age of the Ṛgveda is really no barrier to the Aryan authorship of the Indus culture (if other evidence proves that hypothesis) for in the first instance, that age is not known with even an approximate degree of certainty, and secondly, because the Ṛgveda can safely be taken to have represented a period long posterior to the advent of the Aryans into India. As to the existence of the Aryans in the Indus Valley at so early a period as the age of the Indus culture, it is held by some on the evidence of skeletal material that the Aryans formed part of the diverse population of these days.

Various arguments have been advanced by Sir John Marshall in order to prove that the Indus Valley civilization was quite distinct from, and earlier than, the Vedic civilization. One of his principal arguments viz., the borrowing of the Śiva cult of Mohenjo-daroby the Vedic Aryans, has been noted above...

Although Sir John Marshall's view is now generally accepted, some scholars still regard the Vedic civilization as older than that of the Indus Valley. It is impossible, at the present state of our knowledge, to come to any definite conclusion, but it has to be admitted that there is no conclusive evidence against the view that ascribes the authorship of the Indus valley civilization to the Ṛgvedic Aryans, and regards it as a logical corollary, a lineal descendant, of the culture described in the Ṛgveda".

History is perhaps the only field of modern science wherein diametrically opposite propositions can be presented as proved and so many times the historical accounts tend to be disgusting. But here in the words of Pusalker we have got a very delightful piece of history written scrupulously on the lines described by R.C.Majumdar, which we saw earlier. Author has made no effort to impose his opinion with a garb of pseudo-scientific analysis as in the case of Debiprasad Chattopadhyaya. Now to understand the popular perceptions getting shared among the intelligentsia, just have a look at the review of Debiprasad Chattopadhyaya's book, 'History of Science and Technology in Ancient India -The Beginnings', that appeared in Nature.

(c) R.Temple: (Nature, January 1988 P.127)

"Indus Valley astronomy is less fully treated because less evidence survives, but it was fairly advanced and ingenious analysis of one datum has yielded a precise date of 2357 B.C. for an observation. Failure of scholars to decipher the Indus script makes various speculations on Indus astronomy controversial, though many surviving short inscriptions seem to refer to stars (represented by a fish sign).

Author bravely attacks "Hindu revivalism " and the obscurantist doctrines of the religious fanatics of India, pointing out that even many modern Indian scientists are tainted by it. This has resulted in a wide spread unwillingness among devout Hindus to acknowledge indebtedness to the Indus Valley Civilization, which preceded the Aryan invasion of India and which collapsed about 1500 B.C., Chattopadhyaya takes this bull firmly by the horns, demonstrating conclusively that the mathematics and geometry preserved in the Hindu Sulvasutras can be only Harappan in origin... For thousand years between 1500 and 500 B.C., India had no form of writing. Most science disappeared. But it was during this period that the early Hindus developed linguistic science to its highest pitch in world history. The motivation was the need to preserve immensely long texts orally without so much as a syllable out of place. Stemming from this extraordinary feat of linguistics came

the foundation of phonetics, etymology, semantics and the most complicated grammar in the world, that of classical Sanskrit."

Note the warped analysis and the time allotted for the development of Sanskrit linguistics- just 500 years. Chattopadhyaya* has showered immense praise over the linguistic attainments of the Rgvedic peoples but was not ready to give even the least benefit of doubt for the possibility that the Indus civilization can be Vedic. To understand the biased frame of mind with which he wrote the history of science and technology, it will be interesting to note that on page 263 he has quoted from the Vedic literature to illustrate the "arbitrariness of the interest in astronomy of Vedic priests" and this negative evidence formed the basis of the analysis that credited the astronomical records of the Vedas to the 'Dravidians of Harappa'. He had absolutely no Dravidian evidence to quote in support of the revolutionary accreditation he has made. In pointing out these discrepancies my aim here is not to discredit any individual or Institution, but only to warn my fellow researchers of the dangers inherent in the tendency to subscribe thoughtlessly the views of established authors writing under institutional sponsorship to add grandeur to their deep-seated prejudices.

At the turn of the present century Sir John Marshall continues to be the hero among the mainstream historians but certain recent developments have struck the very bottom out of the so called "Aryan Invasion Theory" and the ground is set for a revision of the established notions that place the Vedas chronologically at 1000-1500 BC. Portals of truth has begun to become apparent with the decipherment of the Indus script vis-a-vis the discovery of Vedic glossary on the Indus seals by Dr.N.Jha.

(d) Decipherment of Indus Script by Dr.N.Jha

According to Dr.Jha, Vedic civilization had its spread in the 'Sapta-sindhu pradeśa' referred to in Ṛgveda X. 75-5*. He has quoted Chapter 342 of Mahābhārata – ślokas 71-

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* *"What appears to be more unfortunate is that behind the anxiety to impute to the Vedic peoples undue achievements, what was really something of the nature of extra-ordinary importance about them from the view point of the history of science is often obscured or ignored. The very composition of Rgveda – embodying as it does 1,028 songs or hymns by pre-literate or pastoral peoples - is itself a wonder of wonders. No less a wonder is the preservation of it by sheer retentive memory. The literary merit of this vast literature is discussed by others and falls outside the scope of our discussion. What is within the scope our discussion – and without which no history of science in India can be adequate – is the technique developed for its preservation in memory, with meticulous care for rightly pronouncing each syllable in the vast literature, the understanding of the metre in which each hymn is composed, the grammatical syntax of their composition, their exact meaning, and so on, though not without internal controversies among later thinkers who got absorbed in such problems. Understandably, all this formed the starting point of a number of formal sciences, like phonetics, metrics, linguistics, etc."*

* *We have a rare mention of the rivers Ganga, Yamuna, Sutudri (Satlej), Parushni, Sarasvati, Asikni (Candrabhāga or Cenab), and Vitastha(Jhelum) in this hymn.*

73, 88-89, and 92-93 as specifically referring to the subject matter depicted on certain Indus seals. Śloka 73 mentions the recovery of lost Nirukta by Yāska while ślokas 92 and 93 speaks of the two most popular depictions on the seals viz., the Unicorn Bull (ekasr̥ṅga) and the humped bull (trikākūt) respectively. I have no doubt as to the correctness of this spectacular discovery – a creative leap over the absurd scholarly inventions. The high antiquity of not only the Vedas but also of the entire Vedic literature including the Brāhmaṇas and Upaniṣads can no longer be doubted and the credibility of Vedic literary evidence stands reestablished to an irrefutable level. Moreover Jha has brought to light the existence of Śaiva-Āgama, Śvetāśvataropaniṣad and Yoga in the days of the Indus Valley civilization. The confirmatory evidence rendered by Jha's decipherment offers great solace for scholars who have been steadfastly stuck to the proposition that the Indus civilization can only be Vedic in character. History as created by people like Sir John Marshall, M.Wheeler and D.P.Chattopadhyaya is in dire need of revision as the Aryan myth has crumbled with the surfacing of Sanskrit glossary in the ruins of Indus Valley civilization. Time is thus ripe to attempt a better appreciation of the ancient Indian historical tradition that we find reflected in the Vedas, Purāṇas and the Epics.

3. Intricacy of Indian Chronology

(a) Continuity of Indian Tradition and the sheet anchor of Indian Chronology

R.C.Majumdar gives us a very clear picture:[14]

" The chief difference between India and the other ancient countries mentioned above lies in the continuity of her history and civilization. The culture and civilization of Egypt, Sumer, Akkad, Babylon, Assyria, and Persia have long ceased to exist. They are now mere past memories and their history possesses only an academic interest. Indian history and Institutions, however, form an unbroken chain by which the past is indissolubly linked up with the present. The modern peoples of Egypt and Mesopotamia have no bond whatsoever with the civilization that flourished millennia ago and its memorials have no more (usually very very much less) meaning to them than to any enlightened man in any part of the world.

But not so in India. The icons discovered at Mohenjo-daro are those of gods and goddesses who are still worshipped in India, and Hindus from the Himālaya to Cape Comorin repeat even today the Vedic hymns which were uttered on the banks of the Indus nearly four thousand years ago. This continuity in language and literature, and in religious and social usages, is more prominent in India than eve in Greece and Italy, where we can trace some continuity in history...."

[14] The Vedic Age, Bharatiya Vidya Bhavan, Mumbai, 1996, p.38

A.L.Basham conveys almost the same impression as above but with a little bias in his 'interpretation':[15]

"The ancient civilization of India differs from those of Egypt, Mesopotamia and Greece, in that its traditions have been preserved without a break down to the present day. Until the advent of the archaeologist, the peasant of Egypt or Iraq had no knowledge of the culture of his forefathers, and it is doubtful whether his Greek counterpart had any but the vaguest ideas about the glory of Periclean Athens. In each case there had been an almost complete break with the past. On the other hand, the earliest Europeans to visit India found a culture fully conscious of its on antiquity – ***a culture which indeed exaggerated*** *that antiquity, and claimed not to have fundamentally changed for many thousands of years. To this day legends known to the humblest Indian recall the names of shadowy chieftains who lived nearly a thousand years before Christ, and the orthodox Brahman in his daily worship repeats hymns composed even earlier...."*

The color of Basham's eyes has surfaced where I have added emphasis. Attributing exaggeration to a culture that professed 'Satyameva jayate' in fact is an abuse inspired by a lack of comprehension. A continuous tradition must obviously mean a continuous history, but surprisingly that is not the case with India if we look for chronicles other than the Purāṇas. As far as Purāṇas are concerned they are conflicting in themselves and with each other and do not offer a convincing chronology to the modern historians. This predicament has given rise to an official line of history getting sponsored by the Government (which finds a place in the curriculum of the schools and is followed by a majority) with which a number of scholars are on an incessant conflict that questions the very foundations of the chronology adopted by the National Institutions of historical research. An ideal starting point for a discussion will be the famous words of F.Max Muller:[16] *"...although we look in vain in the literature of the Brāhmaṇas and Buddhists for any allusion of Alexander's conquest and although it is impossible to identify any of the historical events related by Alexander's companions with the historical traditions of India, the name of Sandrocottus or Sandrocyptus, the Sanskrit Chandragupta is there to form a connecting link between the history of the East and the West".*

These words in themselves are illustrative of the weakness of the hypothesis and another westerner M.Trover had disputed the above identification in his introduction to the translation of Kalhana's Rajatarangini as early as in 1859 A.D., Trover did communicate his views to Max Muller, but the latter did not respond obviously realizing the incapacity to defend his views. The above identity of "Candragupta Maurya with Sandracottus of the Greek records" proposed by William Jones and supported by F.Max Muller went on to become the sheet-anchor of Indian history and paved the way for a controversy that

[15] A.L.Basham, p.4

[16] Secondary source-'Search for the year of Bharata War' P.14

remains yet unresolved. Unfortunately history cast by Romila Thapar[Ψ], A.L.Basham and the likes do not present the facts as it is; they write as if they were witnesses to, say, the birth or coronation of Candragupta Maurya as well as the invasion of Alexander, and are not at all in doubt, even to the extent of William Jones or Max Muller. On the contrary many scholars like Kota Venkatachalam, K.D.Sethna, D.S.Triveda, Shriram Sathe etc., have challenged the chronology erected on the above fictitious identification. The following remarks of Sethna are especially noteworthy to the context of our discussion:[17]

" ...the discovery of the Indus Valley civilization, whatever its exact time-bracket, has carried the antiquity of Indian history substantially upward. Later archaeology has penetrated still further beyond this civilization to one developed enough to have a sense of town planning, build with molded and kiln-baked bricks and make a distinctive pottery. M.R.Mughul has found in Cholistan (former Bahawalpur State) the "Hakra Assemblage or Complex" dating back to 3500 B.C. Hence there is ample room for a pre-Harappan Ṛgvedic culture. And if, as Pusalker and a few others contend, the Indus Valley Civilization was posterior and not anterior to the Ṛgveda, we may have on our hands a revolution changing much more than the mere relative ages of the two. So great an antiquity for the Ṛgveda may demand a shifting upward of several post-Ṛgvedic occurrences, including the Bhārata War if that conflict has been put anywhere close to Pargiter's date. Then we should have to question whether a number of historical events which we have thus far felt secure in dating within the 6 centuries before Christ – the death of Buddha, the advent of the Maurya dynasty, the Rock edicts of Aśoka – are not to be chronologically reconsidered".

The archaeological identity now we have gained for the 'Aryan Ṛgvedic culture' with the Indus valley civilization and the continuity of tradition that has become all the more apparent in fact necessitate a search for the Millenniums that now intervene between the Rgveda and Maurya dynasty. Pargiter had placed the Ṛgveda and the Maurya dynasty just across a span of thousand years or less(1500 BC – 300 BC) while we now encounter a situation that place them across 4000 or 3000 BC to 320 BC, allowing room for a tradition more by, say, 2000 years. Obviously we cannot reconcile the established identity of Candragupta Maurya with the namesake of Greek records without closing our eyes to the archaeologically evident continuity of Vedic tradition. Perhaps the split we had in our historical thinking about the identity of Sandracottus in it self was a pointer towards the need for a revision.

[Ψ] "Chandragupta Maurya succeeded to the Nanda throne in 321 B.C. He was then a young man of about twenty-five and was the protégé of the Brahman Kautilya...", A History of India-Volume I, P.7O

[17] K.D.Sethna, Ancient India In A New Light, Aditya Prakasan, New Delhi. Introduction p. iii

(b) Beginning of Kaliyuga

No description of Indian chronology is possible without referring to the beginning of Kaliyuga. In terms of popular records, Āryabhaṭa, who lived in the sixth century AD, perhaps spoke for the first time of an antiquity of 3600 years for the beginning of Kaliyuga and the Bhārata war. Aihole inscription of Pulakeśin II referred to 3735 years of Kaliyuga that coincided with the year 556 of the Śaka era and rendered archaeological support to the tradition reflected in Āryabhaṭīyaṃ. Much of the Purāṇic chronology tends to have an inherent dependence upon the Āryabhaṭa tradition that places Kaliyugādi in 3102 BC. The chronology deciphered out of the Bhāgavatapurāṇa by William Jones in January 1788, also had its beginning with the Kaliyugādi of 3102 BC.

S.No.	Dynasty	No.of Kings	Duration	Period-Before Christ
1	Brhadratha	20	1000	3101-2100 BC
2	Pradyota	5	138	2100-1962 BC
3	Shisunaga	10	360	1962- 1602 BC
4	Nanda	1	100	1602- 1502 BC
5	Maurya	10	137	1502-1365 BC
6	Shunga	10	112	1365-1253 BC
7	Kanva	4	345	1253-908 BC
8	Andhra	32	456	908-452 BC

Being unable to reconcile[Ψ] with this high antiquity, Jones searched for alternate options and ultimately he found in the Greek classical accounts the Sandracottus of Palibotra to represent Candragupta Maurya, whom the Purāṇas placed at 1500 BC. By this identification Jones could reduce the antiquity claimed by Brāhmans by 1200 years and at least for the time being saved the tower of Babel from sinking...([+]). To keep the Mauryan identity of Sandracottus valid it was necessary to downplay the Āryabhaṭa / Aihole tradition of Kaliyugādi and towards this end Fleet[(φ)] alleged that the '3102 BC tradition'

[Ψ] On the Puranic chronology the comments of Jones were: " Thus we have given a sketch of the Indian history through the longest period fairly assignable to it, and have traced the foundation of the Indian empire above 3800 years from the present time; but on a subject in itself so obscure and so much clouded by the fictions of the Brahmins, who, to aggrandize themselves, have designedly raised their antiquity beyond the truth, we must be satisfied with probable conjecture and just reasoning from the best attainable data."

[+] Frederich Bodmer: " Custodians of the Pentateuch were alarmed by the prospect that Sanskrit would bring down the tower of Babel". 'The Loom of Language', Newyork, 1944, P.174

[(φ)] " Around 400 AD astronomers realized the need to have a specified reckoning with a definite *initial occasion. They found the required occasion in what a backward computation by them gave as* a conjunction in 3102 BC of the sun, the moon, and the five then-known planets at the first point of the Zodiacal sign Mesha (Aries). The reckoning thus devised was subsequently identified with the Kaliyuga of which the Purānas speak. The identification is first found, though without the actual name, in the astronomer Āryabhaṭa in 499 AD. By then the Purānic pundits must have adjusted India's traditional history to the new date, fixed the time for the Kaliyuga's close companion , the Bhārata War and constructed a whole long chronology. The acceptance of the new date must have

was the handiwork of the 4th century Siddhāntic astronomers while some others credited Āryabhaṭa itself with the invention of astronomical Kaliyuga.

4. Historicity of Āryabhaṭa Tradition

The strongest and wisest refutation of the charge leveled by Fleet comes from Sethna:[18]

"If the old chronology was cooked up some time after 400 AD and was already in public use by 634 AD, then according to the chronology of modern historians the Purāṇic pundits who did the cooking-up lived face to face with the Guptas whose period by the modern chronology is counted from 320 to 570 AD. But we have submitted that the Indian time-scheme, the work of those very pundits, must begin the Guptas in the last quarter of the 4th century BC. Hence we have the ridiculous situation that the pundits set contemporaneous kings over 600 years before their own time!

Surely, there is a limit even to the lack of historical sense we may attribute to Indian chronologists . Critics of the Puranic time-scheme would definitely overshoot the mark by asking us to believe that an Indian living day after day under a particular king could be mad enough to push publicly the same monarch back in history by more than 6 centuries. Here is a reductio ad absurdom of the modern criticism and of the chronology currently accepted."

As Sethna himself points out, this refutation does not mean that the Purāṇic records are correct and straightforward:[19]

" Of course, this does not necessarily make the date for the Purāṇic Kaliyuga historically correct. Nor do we need, for the correctness of equating Sandrocottus with the founder of Guptas, to have all ancient events reoriented chronologically with the Kaliyuga of 3102 BC as a reference point. We may admit several items in the old Indian historical system to be incorrectly dated..."

It is apparent from the above that the 'Evangelic history' and the confusing Purāṇic accounts have together thrown the inquisitive Indian minds into a fix as to what really is the shape of Indian chronology. A number of scholars have worked overtime in the last few decades to achieve a breakthrough relying on different emendations and interpretations of Purāṇic verses and certain astronomical verses of Varahamihira. Neither of them has been successful enough and as such we are not left with a

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become universal by 634 AD, for in that year we have the public use of it in the Aihole inscription dating itself in the Kaliyuga Era side by side with the well known Śaka Era of 78 AD and referring also to the Bhārata War . But as the former Era is not a historical one, the entire system of dates the Purānic pundits deduced from it and from the Bhārata War for events is arbitrary. All the ages they have assigned to the various dynasties of the past have no historical value."

[18] Ibid, p.16

[19] Ibid, pp.15-16

satisfactory solution to reproduce here. On the contrary the baseless propositions they have created to justify the inconsistencies apparent in Purāṇic literature have only helped

to make the picture of Indian chronology murkier. A hope over the different propositions shall be a rewarding exercise in trying to comprehend the intricacy involved.

Evidences In Favor Of Āryabhaṭa Tradition

1. As noted by Sethna, much before Āryabhaṭa, Megasthenes[τ] had reported an antiquity of 6000 years for the Indian genealogy of kings. Āryabhaṭa's astronomical computation was not a necessity for conceiving a distant epoch like 3102 BC. Such an epoch in fact forms a part of the legends of all ancient civilizations like Mesopotamia, Egypt etc. Even in south America Maya records speak of a creation Era of 3114 BC. Kaliyugādi (we shall denote hereafter as $\mathbf{K_0}$) at 3102 BC was therefore undoubtedly not an invention of Āryabhaṭa. Fleet's arguments obviously carry no weight at all. More so, because no one has ever demonstrated the process of back computation done by the astronomers of 4th century AD.
2. Apart from Āryabhaṭīyaṃ and Aihole inscription Harisvāmy has referred to Kali year 3047 in his commentary of Śatapathabrāhmaṇa.
3. Greek classical accounts do not support the identification of Candragupta Maurya with Sandracottus because of the following reasons:

   (a) Sandracottus ruled over Prāssi with his capital at Pālibotra, situated 425 miles up from the confluence of Jomanes and Ganges (Prayaga-Allahabad) or 738 miles from the point where Ganges falls in the sea. This precisely given location rules out the possibility that Pālibotra was Pāṭalīputra. Further, the river Jomanes flowed through Pālibothri to reach Ganges between the towns Methora and Carisoboras and according to Pliny 'The Indus skirts the frontiers of Prāssi'.

   (b) Pt.Bhagavaddatta after a detailed analysis of the Greek accounts has given the following conclusion. Prabhadra or Palibhadra situated 200 miles up from Prayaga on the way to Mathura was the capital of Prassi and they had a king named Candraketu who could be identified as the Sandracottus of Greeks.

   (c) According to Kota Venkatachalam[⊕] the other names of the Greek records – Xandrammes, Andrammes, Agrammes, Androkottus, Amitrochades and

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[τ] Pliny (VI.21. 4 –5), Arrian (Indica I.9) and Solinus (52.5). See P.15 of Sethna

[⊕] I have seen only a secondary source, Dates of the Buddha by Shriram Sathe, P.106. Sathe has quoted Kota Venkatachalam:

"No attempt has been made by the protagonists of this identity of Sandracottas with Chandragupta Maurya to explain the various names Xandrammes, Andrammes, Agrammes, Androkottus, Amitrochades and Sandrocyptus which were used by the Greek classical writers to denote three different kings, as referring to respectively, the last king of the previous dynasty, the usurper who killed his predecessor and the son of this usurper who concluded a treaty with Seleukas Nikator. The last king of the previous dynasty is named by the Greeks as Xandrammes, Andrammes or Agrammes. The usurper is named as Sandrokottas or Androkottas

Sandrocyptus – have received no explanation at the hands of the followers of Jone's theory. (V.A.Smith has referred to this inconsistency in the following words: "The king of Gangaridai or Prāssi...was named as nearly as the Greeks could catch the unfamiliar sounds, Xandrammes or Agrammes ...who must have been one of the Nandas mentioned in the tradition".)

(d) The association of Candragupta Maurya with Cāṇakya had been so popular as to become a part of the legends as well as to appear in the history by Romila Thapar who calls Candragupta a protégé of the Brahman Cāṇakya. But the Greek records do not contain a mention of this kingmaker or his popular treatise on economics – Arthaśāstra. How can Megasthanese who stayed over in the court of Candragupta for a pretty long time can be forgetful of this legendary Brahman?

(e) Further Greek records are silent about Magadha, Nanda, Aśoka the Great and Buddhism while the literature of the Mauryan period is devoid of any references to Alexander, Porus or Megasthenes.

(f) Sethna's Thesis

Sethna has drawn heavily on the 'Indian antiquity' reported by Megasthenes(302 BC) and available in the Greek records to refute the 'Mauryan equation'. The salient features of his analysis are:

(1) According to Pliny: "From the days of Father Bacchus to Alexander the Great, their kings are reckoned at 154, whose reigns extended over 6451 years and 3 months." Solinus gives the same period while Arrian states as 6042 years.

(2) Fixes the invasion of Alexander to 13 April 326 BC and on this basis the initial point of Indian chronology according to the version of Megasthenes is deciphered as 13 January 6777 BC.

(3) The above initial epoch of 6777 BC is interpreted as the most likely beginning point of the Saptarṣi cycle with the Sages in Aśvini. As such in the subsequent period Sages enter Maghā in 5877 BC, 3177 BC and 477 BC. The traditional Purāṇic chronology places the Bhārata War and the birth of Parīkṣit in the Magha century of Saptarṣis that happened between 3177-3077 BC.

(4) Like many other scholars who have worked on to justify the traditional Purāṇic chronology, Sethna also postulates the existence of a Śaka Era from 551 BC for solving the conflict created by the Varahamihira and Kalhaṇa with the Kaliyugādi of 3102 BC.

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and the son of the usurper is Sandrocyptus or Amitrochades. Let us compare the Greek and Indian accounts. According to the Indian tradition, Nanda or more precisely Sumalya Nanda was the immediate predecessor of Chandragupta Maurya and Bindusara, the son of Chandragupta was the successor.

If by Sandrakottas, we are to understand Chandragupta Maurya, we have to understand by Xandrammes, Nanda or Sumalya Nanda and by Amitrochades or Sandrocyptus, Bindusara. Now there is some verbal similarity between Sandrakottus and Chandragupta but there is not even a trace of verbal similarity between Xandrammes and Nanda or between Sandrocyptus and Bindusara".

(5) Candragupta I and Samudragupta of the Imperial Guptas are placed against the Sandracottus and Sandrocyptus of the Greek records at 315 BC.

(6) Postulates a Malava Era from 711 BC and Guptakāla from 315 BC. Places Aśoka at 950 BC, Candragupta Maurya at 999 BC, and Buddha at 1088 - 1168 BC.

Purāṇic chronology and the incompleteness as well as inconsistencies of the historical records have together given rise to a number of new propositions at the hands of Sethna.

Inconsistencies of the Āryabhaṭa Tradition

Despite the authentications of Āryabhaṭa and Aihole inscription, a close examination reveals several loopholes of the Purāṇic accounts.

(a) Varāhamihira places Yudhiṣṭihra at 2526 years before the Śaka Era when the Saptarṣis were in Maghā. Kalhaṇa has subscribed to this view in his Rājataraṅgiṇi and has placed the Kurus and the Bhārata War in Kali 653 or 2448 BC instead of 3102 BC.
(b) Certain Jain and Buddhist traditions place the beginning of a Yudhiṣṭira Era at 468 Kali or 2634 BC.
(c) Purāṇic sources are not unanimous in placing Kaliyugādi at 3102 BC. According to an inscription of the Hanuman temple at Jaisalmer, Kaliyuga began with the first coronation of Yudhiṣṭira at Indraprastha.
(d) Saptarṣis cannot be in Maghā at both 2449 BC (653 Kali) and 3102 BC. Obviously this is indicative of the confusion with which the Purāṇic chronicles took shape. Matsyapurāṇa (Ch.271-41) supports a tradition with Saptarṣis at Kṛttikā in the beginning of Kali and this situation contradicts the Saptarṣi cycle that Sethna has relied upon.

5. Controversy of Śaka Era- Invalid astronomical evidences

All those historians who have stuck to the period around 3102 BC for the beginning of Kaliyuga had to rely upon the hypothesis of a new Era to wriggle themselves out of the above contradiction on Yudhiṣṭira and "Śakakāla" posed by Varāhamihira in Brhatsamhitā (XIII.3). Most of the Indologists have taken it as 'Śālivāhana Śaka' while a few which include T.S.Narayana Sastry (1918), Kota Venkatachalam (1950), Prof. V Thiruvenkatacharya(1950), Dr.S.Triveda (1963), Prof. K.Sreenivasa Raghavan(1980s), E.Vedavyas etc. have kept alive the tradition of advocating a certain Cyrus Era or Andhra Era beginning from 550 BC. But as early as in 1958 the thesis received a stout refutation at the hands of T.S.Kuppanna Sastry and K.V.Sarma, in two remarkable papers[Ψ] that exposed all their claims of astronomical support. The concluding paragraph penned by these eminent scholars is noteworthy:

Ψ (1). The Saka Era of Varahamihira: Salivahana Saka, Journal of Indian History- XXXVI (1958), pp. 347-367 and (2) The Untenability of the Postulated Saka Era of 550 BC, Journal of Indian History-XXXVII, pp. 201-224.

" Now these people have taken all this trouble in order to prove the antiquity of the Indian dynasties and in so doing to reconcile texts of varied historical worth. Let them by all means attempt it, for it is only too true that unconscious prejudice has had some hand in the writing of the history of our land. But what we wish to show here is that their stand on the interpretation of the Saka Era, with all its ramifications, is wrong, and will not help them, as also the various other ideas of their's which we have shown to be wrong. Also we wish to point out that attributing base motives and questioning the bonafides of people (the writings of TSN and KV are replete with these) will not only not help, but may also be "paid back with interest," as Dr.Kane says".

TSK Sastry and KV Sarma did examine only the astronomical evidences involved and they did not touch upon the controversy as regards the identification of Sandracottus with Candragupta Maurya. They spoke at length on the motion of the Sages and showed that it is direct rather than retrograde as assumed by the followers of Cyrus Era like Dr.S.Triveda. There remains no related astronomical proposition that they have not touched upon and it is quite surprising that despite such repudiation at the hands of these well-known astronomers the thesis could surface again in the 1980s with people like KS Raghavan and Vedavyas. In fact an objective look at Pañcasiddhāntika and other Siddhāntic treatises can convince anyone that it is ludicrous to place Varāhamihira in 123 BC instead of 505 AD, Bhattotpala in 338 AD and ascribe anterior dates to astronomers like Āryabhaṭa I, Bhāskara I, Brahmagupta, Bhāskara II etc.

6. Date of Bhārata War – Prof. P.C.Sengupta

P.C.Sengupta made a most authentic and unbiased astronomical study of this topic in 1941 AD. Important conclusions are:

1.Date of the present recension of the epic Mahābhārata

Aśvamedhika parva 44-2 refers to first of the seasons as winter and nakṣatra as Srāvaṇa implying the fall of winter solstice over Altair. The great epic might have emerged after devouring up its earlier versions around the time of this calendar phenomenon around 300-400 BC.

2. Bhārata war

Based on the astronomical references to luni-solar positions and the winter solstice Prof. P.C.Sengupta arrives at two approximate dates by two different methods viz., 2432 BC and 2450 BC which very nearly agree with the date emerging from Varāhamihira's statement in Brhatsamhitā i.e.,(-) 2526 of the Śaka Era which correspond to 2449 BC. After examining the luni-solar calendar phenomena of 2449 BC in contrast to the astronomical references of the Epic Sengupta reaches the 'most definite conclusion that the Bhārata battle did actually take place in (-)2526 of Śaka Era or 2449 BC'.

But to arrive at the above most definite conclusion he had to reject all the astronomical data available in Chapter 143 of the Udyogaparva and Chapter 3 of Bhīṣmaparva with the comment that -

"I have understood them to be mere astrological effusions of bad omens; they are alsc inconsistent in themselves, and as such they cannot have any bearing as to the date of the Bhārata battle".

This in fact is a contradiction as he has described the astronomical references as strikingly consistent earlier in fixing the date of the war as 2449 BC. According to Mr.Vedavyas:

"What is in question is not the inconsistency of Mahabharata but the consistency of Sengupta's views..."

3.Sengupta has termed the Āryabhaṭa tradition as an " astronomical fiction" that is at serious conflict with the Mahābhārata evidences.

Dr.E.Vedavyas has attempted an antithesis of Sengupta's work in his Ph.D thesis submitted to the Andhra University. It carries a forward by Dalai Lama, but its contents are, scientifically speaking, not very correct.

7. Date of the Buddha and Śaṅkara

Here we have got two more riddles of Indian history- Buddha's more than 35 dates are known between 1900 BC & 485 BC while only three dates viz., 509 BC, 44 BC, and 788 AD are popular with Sankara. The official line of history fixes the date of Buddha based on the Mauryan-Sandracottus equation that places Candragupta Maurya in 320 BC. Accordingly Asoka's coronation is at 265 BC and Buddha's nirvana took place 216 years before i.e., in 483 BC. As Buddha lived for 80 years his date of birth turns out to be 563 BC. Kota Venkatachalam on the other hand dated Buddha exclusively relying on Purāṇic data. Salient features of his work are:

Yudhiṣṭira Era: 3138 BC (beginning)
Kali Era : 3102 BC
Saptarṣi Era : 3076 BC

Dynasties of Magadha (Bhāgavata Purāṇa: XII.1- 43)

Dynasty	No.of Kings	Years
Brhadratha	22	1006
Pradyota	5	138
Śiśunāga	10	360
Nanda	2	100
Maurya	12	316
Sunga	10	300
Kaṇva	4	85
Āndhra	32	506

This table is only slightly different from the one that William Jones produced initially from the Bhāgavatapurāṇa. As per the above chronology Candragupta Maurya comes at 1534 BC and Buddha at 1887 BC.

As regards Śaṅkara, the different Maṭhs are having conflicting records: Śārada pīṭhaṃ of Śṛṅgeri has the record of a Śaṅkara born in 44 BC while Kāmakoti pīṭha agrees with the Brhatśankravijaya of Citsukācārya that Śaṅkara was born in Kali 2593 or Yudhiṣṭira Śaka 2631. But the official version of history identifies the 38[th] Ācārya of Kāmakoṭipīṭha – Abhinava Śaṅkara – as Śaṅkarācārya and places him at 788AD.

8. What We Must Note...

It is apparent from the above that the realm of Indian History in fact is a labyrinth of confusing theses ingeniously drafted by competing scholars without any concern for the true facts. Even in the period since independence the national institutions concerned with historical research have not taken any steps to present the facts as it is. No one has given any cognizance to what R.C.Majumdar has stated as a cardinal principle for observance:

"... But it is better to plead ignorance, express doubts and put forward alternative possibilities rather than definitely uphold a view on meager and insufficient grounds...."

As a result the laymen who tend to accept the established notions as true facts has to carry the burden of the distorted picture all through his life. This unfortunate situation has an important bearing upon the history of astronomy. Historical conclusions such as the dating of the Vedas to 1500 BC, which can at the best be treated as provisional, if accepted as true facts shall come in the way of further research in all related fields. Many such established notions have assumed the form of touch stones in Indian historical research and those who are trying to reach the truth must be beware of such psychological hurdles standing along the path. History of astronomy is very much the same as the political or social history of India, and is strewn all along with established touchstones created by lopsided research. We should not allow ourselves to be guided by such old and obsolete propositions in the evaluation of the new and creative approaches towards the controversial aspects of Indian antiquity.

As far as the present author is concerned there is no question of crediting aggrandizement or perpetuation of falsehood upon the authors of Purāṇas. He is fairly convinced that the identification of Candragupta Maurya with Sandracottus is squarely wrong and the conflicting purāṇic accounts are no excuse for maintaining such a falsehood. Obviously a revision is necessary for the dates of Buddha and Śaṅkara. As far as the dates of Kaliyugādi and Bhārata war are concerned the problem lies in our understanding of the subject matter and language of the Epics and the Purāṇas, the original versions of which might have come into existence probably before the fall of Indus-Sarasvati settlements. In the process of re-creating them along with a new script, confusion might have crept in due to an improper understanding of the cryptic language employed in the original versions. We shall revert to a more detailed examination of this aspect towards the end of this book.

If We Accept the History by Romila Thapar...

If Viśvāmitra happens to be simply a priest of the 'semi-nomadic pastoralists' of 1200 BC, do we have any heritage worth that name to be proud of?

Can anyone explain the possession of the most sophisticated language among the nomadic Aryan tribes? Can the 'metres' be created by an illiterate community? As for example, how can we conceive the genesis of Gāyatri, had Viśvāmitra been not literate enough as to record his thoughts and to configure it as a mantra in accordance with cannons of metrics? Without the technique of writing it was impossible for the 'Chandah-śāstra' to develop and in the absence of this discipline no hymn would have come in existence? Are we irrational enough to imagine that the nomadic Aryans had their thoughts conditioned in terms of metrics and the mantras got evolved and recorded automatically in their brains for being taught to their disciples later on? Just imagine one fine morning when Viśvāmitra is sitting along with his disciples, Gāyatri comes into being all of a sudden.... Such history, which depicts the Vedic Ṛṣis as illiterates or neo-literates, can only be termed as rubbish! We need to liberate ourselves from the lopsided perceptions of these historians for any meaningful inquiry into the Indian antiquity possible.

Gāyatri Speaks....

To all creative minds Gāyatri speaks eloquently of the aspirations of the Vedic intellect and the long civilizational history Viśvāmitra had behind him. Veda - literally means knowledge - is a compilation of mantras or hymns considered to be of divine origin and ascribed to a long tradition of Ṛṣis who has preserved and handed down the sacred wisdom from generation to generation with the most reverential care as regards the style of recitation, syntax as well as structure. According to the Purāṇas, Śri Kṛṣṇadvaipāyana Vyāsa who lived at the junction of the Dvāpara and the Kali Yugas compiled and classified the hymns addressed to various deities into four samhitas namely, Ṛgveda, Sāmaveda, Yajurveda and Atharvaveda. We also have the four Upavedas: Āyurveda, Gandharvaveda, Dhanurveda, and Sthāpatyaveda, and the six appendages known as Vedāṅgas: Jyothiṣa (astronomy), Kalpa (Ritual), Nirukta (Etymology), Śikṣa (Phonetics), Vyākaraṇa (Grammar), and Chandah (Metrics). The wide-class of Vedic literature also include the Brāhmaṇas, Āraṇyakas, and Upaniṣads. A cursory glance over these vast socio-religious literary creations brings to the fore of our minds the startling revelation that the earliest of all civilizations had a most systematic as well as scientific language capable of exceedingly precise and consistent expression. Modern researches in the field of artificial intelligence have corroborated the inherent superiority of Devanāgari script and syntax over other lately developed languages. The elegance of Sanskrit could captivate the American Association for Artificial Intelligence so much so that the cover page of spring 1985 issue of AI magazine had the Sanskrit śḷokas from the 2nd chapter of Bhagavadgītā. In the same issue Dr. Rick Briggs has made the following observation as regards Sanskrit in his paper entitled - 'Knowledge representation in Sanskrit and artificial intelligence':

"It is interesting to speculate as to why the Indians found it worthwhile to pursue studies into unambiguous coding of natural language into semantic elements. It is tempting to think of them as computer scientists. Let us not forget that among the great accomplishments of the Indian thinkers were the inventions of zero, and of the binary number system a thousand years before the West re-invented them. Their analysis of language (Sanskrit) casts doubt on the humanistic distinction between natural and artificial intelligence, and may throw light on how research in Artificial Intelligence may finally solve the natural language understanding and machine translation problems".

The irresistible conclusion to which one is led by the above passage is that even at the close of the 20^{th} century 'Gāyatri' remains capable of shedding light on our path – Vedas have not lost their relevance, they still remain a source of enlightenment.

When, Where and how did the Sanskrit language originate?

This question has no easy answer- it is as perplexing as attempting to conceive the process of origin of a civilization.

- What really are the first steps in the formation of a civilization and the hallmarks of its stages of progress?
- In terms of human progress how can we interpret or evaluate the metaphysical depths of the Vedic ritualistic religion?
- In the evolutionary sequence where shall we place the Ṛṣi-parampara – Kaśyapa, Kauśika, Agastya, Bharadvāja, Atri, Aṅgiras, Vasiṣṭḥa...– on superhuman pedestals?
- Scholars are unanimous in their opinion that the sophisticated language was developed to preserve the mantras alive; but what may be the factors that led them to such a unique requirement quite unheard of in any other civilization?
- In the long line of Ācāryas we find only the compilers such as Pāṇini, Patanjali, Piṅgaḷa etc., – where have gone they who originally conceived the Decimal and Sexagesimal notations, Metrics, and Yoga – without which it was impossible for the hymns to evolve?
- What about the development of other sciences in those days? Can the sophistication that we see in the language be an exception or accident?

To gain the correct perceptions we need to have a look into the history of science with special reference to the Vedic antiquity.

9. History of Science

Our historians had a tendency to rely exclusively upon explicit material records or archaeological evidences in formulating the history of the Vedic civilization. No cognizance was ever given to the incompleteness of the archaeological records and creative vision had no place! Vedic antiquity thus got placed at 1000 BC and the predicament that awaits them now is a rewriting process in the light of the decipherment of the Indus script. Archaeological evidence can never claim completeness as new and deeper excavations are bringing to light new aspects of the history every day. A new skull

surfacing somewhere in the jungles of Africa may warrant a complete revision of the story of human evolution and new excavations may demand further rewriting. We can't foresee an end to this rewriting process!

It is obvious that a creative approach is very much essential to compliment the deficiency of explicit 'speaking' records. For example, if we are able to keep our biases aside, it will appear quite natural to pre-suppose the existence of a very long history for the ritualistic religion and the Vedāṅgas. Only a matured civilization can produce the wonderful language of Sanskrit and the methods employed for the preservation of the vast amounts of religious literature. Sanskrit in fact represents the flowering of Vedic genius and in all likelihood it must have been surrounded by many such 'ārṣa' creations. Unfortunately historians of science have not properly interpreted and highlighted the available evidences to render deserving credit to the Vedic Ṛṣis in the matter of many scientific discoveries. To dispel any doubts that may arise as regards the scientific achievements of the ancient past a remarkable illustration is provided below:

Origin of Spectroscopy In Vedic India

It is true that no one can imagine the existence of an electrically operated 'Spectrometer' in ancient India. This is what happens when the evidences that survived the great depths of time and those we have unearthed archaeologically are scarce and insufficient to draw a real picture of the ancient civilization. What archaeological ruins can be expected of the Ṛṣis who have done their penance deep inside the forests in quite natural abodes? Obviously, the lack of evidence is not a sufficient ground for denial and with whatever little have we got, a creative effort must be made to comprehend the true picture. Creative efforts are of course subjective and every individual may end up with his own images rather than a universally accepted picture. This in fact will be a better situation than imposing a universal view – after all the realization of the truth according to the Indian tradition is a subjective experience!

Wisdom of the Sages

Something quite incredible has appeared in the Indian Journal of History of Science, Volume 29 (4), 1994, under the caption "Dhvāntapramapaka Yantra of Maharshi Bharadvāja" (Spectrometer / Monochromator). Ṛṣi Bharadvāja is well known as the author of 'Vimānaśāstra' – a treatise that failed to gain any appreciation of the modern scientist in view of the apparent incredibility of its claims. Against the backdrop of such attitudes we have another speck of Bharadvāja's wisdom under demonstration in this paper. As regards the subject matter the author says:

"From the library of Oriental Institute, Vadodara(Baroda) a manuscript of Maharṣi Bharadvāja titled 'Amśubodhini' (with a commentary of Bodhānanda) was received. In the introductory passages, it is said that in the original text of Bharadvāja, the aphorisms of 'Amśu-bodhini' are divided in to twelve chapters having one thousand sections. In order to make it understandable, Bodhānanda wrote a commentary on it. Actually the available manuscript is the first chapter of the work, having a commentary over the first fifty

aphorisms of Maharṣi Bharadvāja. The title of this chapter is 'Sṛṣṭyadhikāraḥ' i.e., the Evolution of the Universe. As one goes through the literature, he finds that this commentary appears describing the details of evolution of universe right from 'Bing-Bang' to the evolution of Sun of our Solar System".

Further the text gives the following information:

"In the work 'Yantra-sarvasva' the learned Bharadvāja described 'Dhvāntapramapaka-yantra' (Radiation measuring apparatus or spectrometer, monochromator) as 109th instrument comprised of 32 ancillary components, which is capable to analyze the radiation in general. Further according to Śārikanātha, as out of 32 components only 13 components are sufficient to analyze 'Tama' (ultraviolet, UV) for the moment only these (13) components are described here".

Manuscript contains the design of the instrument and detailed description of the materials out of which the prisms are to be made. The sage has recommended the use of a conical prism and the wavelengths of the Fraunhoffer lines are given in a special unit called Kakṣya. The instrument and the non-hygroscopic material described have been already made at Sah Industrial Research Institute, Varanasi and National Metallurgical Laboratory, Jamshedpur respectively.

Antiquity

Śārikanātha, who is referred to by Bodhānanda in his commentary belonged to the period 780-825 AD. Even at this late date can we think of the existence of a Sanskrit manuscript, which speaks of Fraunhoffer lines? Our ideas about the history of science do not leave any scope for the manuscript to be something other than forgery, as had happened in London ...It is undeniable that an instrument of this sort cannot appear in isolation. In fact it is only one among a group of five spectrometers and scores of other Instruments described by Bharadvāja. What antiquity can we ascribe to Bharadvāja? When Astrophysics was so advanced as to understand the Fraunhoffer lines can we doubt the authenticity and scientific worth of the other descriptions given by the same Maharṣi? Had astrophysics been able to reach such heights, what about astronomy and mathematics?

How could science achieve such unbelievable progress in the pre-historic times? What happened to its custodians? Where from came those Ṛṣis and where have they gone? How could the 'primitive or less advanced' bygone ages leave so much of mystery for the modern Man?

We have to let loose our imagination from the clutches of irrational prejudices to attempt an answer!

With a mind free of all prejudices let's now revert to the questions that confronted us at the end of Chapter I, to continue our quest for the original and true definition of the Zodiac. We shall begin with a serious look into the Siddhāntic astronomy to understand the silent features of the zodiac it embodies as well as its relation to the present day astrological zodiacs prevalent in India.



III

SIDDHĀNTIC ASTRONOMY

"I know that I am mortal and my existence is Grief. But when I study the stellar multitudes, my feet no longer rest on the Earth; I stand next to Zeus, partake of the food of the Gods, and feel myself a God"

Ptolemy

"In this arrangement, therefore, we discover a marvelous symmetry of the universe and an established harmonious linkage between the motion of the spheres and their size, such as can be found in no other way"

Copernicus

"To get any reason out of the mass of incongruity we call human life, we have to transcend our reason, but we must do it scientifically, slowly, by regular practice, and we must cast off all superstition. We must take up the study of the super-conscious state just as any other science. On reason we must have to lay our foundation, we must follow reason as far as it leads, and when reason fails, reason itself will show us the way to the highest plane. When you hear a man say, "I am inspired", and then talk irrationally, reject it. Why? Because these three states – instinct, reason, and super-consciousness, or the unconscious, conscious, and super-conscious states-belong to one and the same mind. There are not three minds in one man, but one state of it develops into the others. Instinct develops into reason, and reason into the transcendental consciousness; therefore, not one of the states contradicts the others. Real inspiration never contradicts reason, but fulfills it."

Svāmi Vivekānanda (Complete Works, Vol. I, 11th edition, pp. 184-185)

III

SIDDHĀNTIC ASTRONOMY

Despite the legends about the eighteen old Siddhāntas, Varāhamihira who lived in the sixth century AD could summarize only five of them viz., Paitāmaha, Vasiṣṭha, Pauliśa, Romaka and the Saura, in his compendium known as Pañcasiddhāntikā. Apart from these works supposedly revealed to divine sages, the traditional Hindu or Siddhāntic astronomy had its inaugural beginning with the advent of Āryabhaṭīya in the Kali year 3600 or AD 499. Since then Siddhāntic astronomy flourished at the hands of a galaxy of astronomers - Bhāskara I, Brahmagupta, Haridatta, Lalla, Muñjala, Bhāskara II, Parameśvara, Ganeṣa Daivajña etc. All these authors presumably represent the nirayana or the sidereal school of astronomy and their works have remained the basis of Hindu astrology during the last fifteen hundred years. The salient features of this indigenous school of Astronomy, especially those which are relevant in our search of the initial point of the Sidereal Zodiac can be understood from the following extracts of the modern interpretations.

1. Modern interpretations & Controversies.

In the last two centuries many Indian and Western scholars like Bentley, Colebrooke, E. Burgess, Whitney, Thibaut, Sudhākar Dvivedi, S. B. Dikshit etc., have studied the merits and demerits of Āryabhaṭīya and Sūryasiddhānta in the light of modern astronomy. As a result widely different opinions have come out regarding the true scientific worth and originality of these foremost classical texts of Hindu (Siddhāntic) astronomy. Bentley's paper on Sūryasiddhānta was published in the 6th volume of Asiatic Researches in 1799 and 'A Historical View of the Hindu Astronomy' was published subsequently which contained many immature conclusions but he remains one of the few Western scholars who could gain a grasp of the intrinsic astronomical content of the Purāṇas:

• John Bentley on Hindu Deity Time

The fact that the astronomical basis of Hindu mythology is apparent to anyone who takes even a cursory look at it may be best illustrated using the words of Dr. John Bentley, published as early as 1823 AD. Before much of what we know today as 'history of science' evolved Bentley had said about the Hindu Gods as:

"*Krishna, as a portion of Vishnu, means time, or the year; for Vishnu being a personification of time, any portion whatever of him must be considered as time also. Hence the figure of Krishna is almost always accompanied with that of one or more serpents, as emblematic of time: for all the deities whose representations or sculptures are accompanied by figures of serpents, are without doubt mere personifications of time, whether taken as the year or time indefinite*".

To this Bentley added the footnote that – *'all the Hindus are Saturnalians, that is, worshippers of time, under various shapes and names, according to different sects*".

We shall not go into Bentley's immature conclusions, as they stand repudiated by far more serious and scientific studies that have taken place ever since. Almost at the same time – Henry Thomas Colebrooke who had come to India in 1782 had his papers published in the Asiatic Researches, Volume 9 (AD1807) & Volume 12 (AD 1816). His notable conclusions are reproduced below from Bhāratīya Jyotiṣa Śāstra, Part – II, by S. B. Dikshit.

• Henry Thomas Colebrooke

Apparently Colebrooke could not have been non-judicious being professionally he had been the Chief Judge of the Civil Court, Calcutta in 1801. Dikshit has given the information that he had spent a lakh of rupees in buying Sanskrit manuscripts – this perhaps explains the genesis of many spurious Sanskrit works containing concocted astronomical and historical details.

⇒ "*I apprehend that it must have been the Arabs who adopted (with slight variations) a division of the zodiac familiar to the Hindus*".

⇒ "*The Hindus have likewise adopted the division of the ecliptic and zodiac into twelve signs, agreeing in figure and designation with those of the Greeks and differing mainly in the fact that their initial point is carried on a few degrees further west than that of the Greeks. That the Hindus took the hint of this mode of dividing the ecliptic from the Greeks, is not perhaps altogether improbable; but, if such be the origin of it they have not implicitly received the arrangement suggested to them, but have reconciled and adapted it to their own ancient distribution of the ecliptic into twenty-seven parts*".

⇒ "*Taking into consideration the analogy, though not identity, of the Ptolemaic system or rather that of Hipparchus, and the Indian one of eccentric deferents and epicycles, no doubt can be entertained that the Hindus received hints from the astronomical schools of the Greeks*".

• Prof. Whitney on the Greek Origin of Hindu Astronomy[1]

Professor Whitney was eloquent in advocating a Greek origin and in bringing to light certain serious lapses of the Siddhāntic treatises. Few of his comments relevant in the present context are:

⇒"*The Hindu system is not one of nature; it is thoroughly artificial structure, full of arbitrary assumption, of absurdities even which have no foundation in nature.... We need only to refer as instances, to the frame work of monstrous chronological periods - to the common epoch of the commencement of the 'Iron Age' (i.e. Kaliyuga) with its exact or nearly exact conjunction of all the planets, to the form of statement of the mean motions*

[1] Quoted by S.B. Dikshit, in History of Indian Astronomy, Part - II

yielding recurring conjunctions at longer or shorter intervals - to the assumption of a starting point of the planets at or near Zeta Piscium... etc. These are plain indications that the Hindu science emanated from one center...The question then of comparative antiquity of single treatises is lost in the higher interest of the inquiry - when, where and under what influence originated the system which they all agree in representing? ....

We regard the Hindu Science as an offshoot from the Greek, Planted not far from the commencement of the Christian era, and attaining its fully developed form in the course of the fifth and sixth centuries... They (Hindus) have been from the beginning distinguished by a remarkable inaptitude and disinclination to observe, to collect facts, to record, to make inductive investigations. The Hindus have ever been weak in positive science; metaphysics and grammar with perhaps algebra and arithmetic - being the only branches of knowledge in which they have independently won honorable distinction... The whole system (of Hindu astronomy) may be divided into two portions. One containing truth successfully deduced, the other composed of absurd imaginations drawn from paurāṇic literature. The question presses itself, then strangely upon us, whether these two portions can possibly have the same origin, whether the scientific habit of mind which could lead to the discovery of the one is compatible with those traits which would permit its admixture with the other?

Surely, we have a right to say that the system, in its from as laid before us must come from another people or another generation than that which laid its scientific foundation; that it must be the work of a race which either had never known or had time to forget, the observing habits and the inductive methods of those who gave it origin...."

With this background of ideas Prof. Whitney confers the final verdict that as there is no evidence of deep astronomical investigations in ancient Indian literature, "*the other alternative, of derivation from a foreign source remains if not the only possible, at least the only probable one*".

It is apparent that no physical / astronomical meaning could be ascribed to the 'Yuga system' and hence Whitney found it an unscientific incorporation of the Purāṇic jargon in to the astronomical science. Scholars like Dikshit have suggested that Āryabhaṭa and others have adhered to the Yuga concept to escape from the stigma of anti-Vedic heresy. This cannot be correct as we see in Āryabhaṭa the uncommon courage to profess a rotation of the earth quite contradictory to the then prevalent notions that we find reflected in the words one of his able predecessors, viz., Brahmagupta. Had Āryabhaṭa been coward enough to subscribe and bring in a purāṇic nonsense into astronomy, he would not have spoken about the rotation of the earth against the traditional belief, as is evident from the criticisms of Varāhamihira, Lalla, Brahmagupta etc. If he stuck to the zero mean longitudes of the beginning of Kaliyuga and the Yuga system, most probably there is a scientific rationale behind the same rather than just the tradition. This aspect will be further discussed later on.

Whitney has pointed out also certain undeniably true circumstances in which we find Indian astronomy even today – after two centuries of researches and half-a-century after political independence. Custodians of 'history of science' in India could do very little other

than quoting a few Vedic hymns to bring out any evidence to annul the following criticisms of Whitney:

⇒ "*The infrequency of references to the stars in the early Sanskrit literature, the late date of the earliest mention of the planets, prove that there was no special impulse leading the nation to devote itself to the studying the movements of the heavenly bodies. All evidence go to show that the Hindus, even after they had received from abroad a systematic division of the ecliptic, limited their attention to the two chief luminaries, the sun and the moon, and contended themselves with establishing a method of maintaining the concordance of the solar year with the order of the lunar months. If, then, at a later period, we find them in possession of a full astronomy of the solar system, our first impulse is to inquire, whence did they obtain it?*"

⇒ "*We come, then, next to consider the direct evidences of a Greek origin. The system of epicycles is essentially alike and the same in both systems. Now notwithstanding the fact that such secondary circles do in fact represent, to a certain degree, true quantities in nature, there is yet too much strange and arbitrary in them to leave any probability to the supposition that the two nations could have devised them independently. But there are sufficient grounds for believing the Greeks to have actually created their own system, bringing it by successive step of elaboration to the form in which Ptolemy finally presents it. The Greeks tell us what they owed to the Egyptians, what to the Chaldeans: we trace the conceptions which were the source of their scheme of epicycles, the observations on which it was based, the inductive and deductive methods by which it was worked out and established. In the Hindu astronomy on the other hand, we find neither conceptions, nor the observations, nor the methods: the whole is gravely put forth as a complete and perfect fabric of divine origin and immemorial antiquity. On the agreement of the two sciences in point of numerical data we will not lay any stress, since it might well enough be supposed that two nations, if once set upon the same track toward the discovery of truth, would arrive independently so near an accordance with nature and one another*".

Given the state of what we have got as Indian astronomy since the days of Āryabhaṭa, none can objectively deny the hard facts expressed by Whitney. The genesis of Siddhāntic astronomy cannot be traced to any reliable Indian sources, original work or observational records. As the world of history of science has come to understand today, the origin of epicycle theory lies with the Greek Apollonius and the 12-sign zodiac has apparently nothing distinctively Indian. Dikshit has proved ably that the epicycle idea was borrowed from Greeks of pre-Hipparchian times as is evident from the value of the solar year. This is a very critical piece of evidence that has not received much attention of other Indian scholars and remains neglected since the days of Dikshit. In the paradigm of Greek development since Hipparchus we can find that none could resist the adoption of Hipparchian solar year – the school of Ptolemy and the Indian are most distinct in this respect, Indians have given no cognizance to the Hipparchus solar year or Ptolemy's solar aphelion. The little details available of pre-Āryabhaṭa days make the matters very confusing but still Sengupta has thrown a valuable insight in his forward to the translation of Sūryasiddhānta by Rev. E. Burgess that certain verses of Sūryasiddhānta seems to reflect the archaic cannons of an earlier school of pre-epicyclic astronomy. Glimpses of this earlier school can be found in Pañcasiddhāntikā also – Dlkshit has quoted the

computation of Venus on page 394 of his history to exemplify the case of Indian astronomical observations. But these kinds of observations and their use in astronomical computations have their perfection in the Babylonian astronomy of the Seleucid era of which we have abundant evidence of cuneiform records. Under these circumstances what credibility can be there for a claim of Indian genesis to the main stream of astronomical development?

Situation is utterly confusing, but a way out may be obtained if we can seriously reflect upon the following words of Dikshit:*

"Revatī was not originally the first point from which the position of planets were measured. It was adopted for the purpose about Śaka 444. It has been shown before that the equinox used to occur in Aśvini about 579 BC. This implies therefore that the initial point or Aśvinyādi for each of the five Siddhāntas of the Pañcasiddhāntikā was not according to Dr. Thibaut's own admission, a fixed point but the position of the equinox, during the period from the date of each siddhānta to Śaka 444. This is perfectly clear so far as the Vaśiṣṭha Siddhānta is concerned. The Pañcasiddhāntikā does not provide any clue to the epoch adopted by the Pauliśa Siddhānta for calculation. Hence, even though its year measure is approximately equal to that of the sidereal year, its initial point must have coincided with the equinox; and since that siddhānta was not in use for many years, its year measure did not affect the results obtainable from it. The original Sūryasiddhānta, however, has adopted the beginning of Kaliyuga as its epoch. With this epoch and the year measure of the Siddhānta one finds that its Aries ingress coincided with the equinox about Śaka 451. But Varāha's remarks clearly indicate that the original Sūryasiddhānta is not so modern. So the moments of equinoxes computed from the Siddhānta would be liable to an error of 1^0 *for every 60 years, to the extent to which its true date may be anterior to the above estimate. This leads one to infer that at the time of the Sūryasiddhānta one of the two factors – adoption of the Kaliyuga date as the conventional epoch of calculation or the length of the year – must have been different from what it was in the days of Varāha, and what we find recorded by Varāha must have been introduced by some one during a century or two before his time".*

These observations coming from a great Indian scholar are very important in understanding the historical context of Indian astronomy. Dikshit has accepted Thibaut's surmises on the zero point and equinox without giving cognizance to the Babylonian tradition of a sidereal zodiac. The sidereal zodiac, solar year of Sūryasiddhānta that Varāhamihira recorded and the Kaliyuga epoch are all essentially Babylonian elements in the period since 3rd century BC. Many year lengths sidereal, tropical and anomalous can be found in Babylonian records including the one – 365.25875 days – which we see in Sūryasiddhānta. What may be the secret of this Babylonian inheritance?

Further, Dikshit has quoted Śākalya's Brahmasiddhānta:

Bhūmikaksạdvādaśāmśe Laṅkāyāḥ prākca Śālmale I
Mayāya prthamaprśne sauravākyamidam bhavet II

* Bhāratīya Jyotiḥśāstra, Vol. II, page: 402 –403.

"In Śālmala, 30^0 east of Lañka, the Sun answered thus to the first query of Maya". Lañka is the position of equator on the longitude of Ujjain and 30^0 east of this point falls in the sea – there's no place answering to the above verse at present.

In the light of these references it is doubtlessly clear that the present form of siddhāntic astronomy necessarily implies a borrowing from Babylonian sources. Therefore, the possibility of establishing an Indian genesis to the astronomical tradition rests exclusively upon the possibility of establishing the existence of distinct Indian roots to the Babylonian astronomy in what we describe as prehistoric times. What Whitney and Colebrooke forwarded are scientific arguments that cannot be refuted if we are able to understand them properly.

• G. Thibaut

Thibaut has generally agreed with the notions of Whitney on the origin and development of the siddhāntic astronomy. But the following words are to be keenly attended to:

"*If we suppose that only a very imperfect knowledge of Greek astronomy was transmitted to India, and that Hindu Jyotiṣas endeavored to erect on that basis a complete system of their own, we can understand how there came into existence works of the types of Sūryasiddhānta which, although evincing a fundamental dependence on Greek astronomy, yet show unmistakable traces of originality in numerous details, remaining indeed in by far the greatest number of cases inferior to their original, yet hitting here and there on new devices and methods of undeniable merit and ingenuity. The perfect Hindu system in that case have to be characterized not either as a mere loan from the Greeks, nor as a mere adoption in the ordinary sense of the word, but rather as a combination and further development. And the merit of originality as far as it goes, would belong to the unknown author of the old Sūryasiddhānta*".

The Siddhāntic corpus of astronomy cannot expect a more fair judgment from any scholar who has really understood it against the background of the Greek and Babylonian science. These Western scholars had little or almost no material before them to be considered as indigenous under the overriding impact of the Hipparchian zero point and theory of epicycles. But still they could feel the existence of something original below these borrowings in Sūryasiddhānta, which as Dikshit has observed had lost its original form by the time of Varāhamihira. It is therefore apparent that if there had been an original Indian school of astronomy its signature may still be available in the Sūryasiddhānta (at least in some mutilated form) and with appropriate efforts the same can be deciphered.

While Colebrook and Dr. Thibaut are on the side of Prof. Whitney, Rev. E. Burgess provides consolation to the Hindus with his comment that in the communication between Greeks and Hindus, Hindus were teachers rather than learners. On the basis of evidences available to him David Pingre has observed that Āryabhaṭa did copy the mean motions from a Greek Table, which of course is of a Babylonian genesis. Van der Waerden and Roger Billard were highly appreciative of the astronomical/observational and mathematical content of the classical texts of Hindu astronomy. It is therefore evident that the West as such has not shown much bias in evaluating the material they had

before them. Unfortunately, no one chose to tread further on the path of John Bentley who had attempted to decipher the ancient epochs of Indian astronomy by imparting an astronomical interpretation to mythological accounts.

• Mystery of the Initial Point

Apart from the dispute over the origin as well as the scientific content we have a more fundamental controversy in the context of Hindu astronomy on the initial point of the sidereal Zodiac, viz., 'Aśvinyādi'. Neither of the Siddhāntic texts provides explicit information on this prime aspect. Dr. G. Thibaut had noted this inconsistency of the Siddhāntas more than a century ago and expressed it in the following words in his introduction to the Pañcasiddhāntikā:[2]

"There is one further point which requires to be touched upon in a discussion of the possible age of the Siddhāntas on which Varāhamihira's work bases, viz. ***the position of the initial point of the sphere from which all longitudes are reckoned.*** *As is well known, all scientific Hindu astronomers speak of that point as the first point of Aśvini or the last point of Revati, and this is manifestly also the tacit presumption for all the different rules given in the Pañcasiddhāntikā; one exception viz. that according to the Pitāmahasiddhānta the first point of Dhaniṣṭhā marks the beginning of the sphere, is specially noticed by Varāhamihira. Now for fixing the precise whereabouts of the first point of Aśvini we have to avail ourselves of the statements as to the longitudes of certain stars which are made in various old astronomical treatises, the earliest of them being the Sūryasiddhānta, according to which the so called Yogatāra of the asterism Revatī has no, or zero longitude i.e., coincides with the first point of Aśvini. And as that junction star which has been identified with Piscium had the same longitude as the vernal equinox in 572 AD, the latter year is supposed to mark approximately the beginning of the scientific period of the Hindu astronomy. If instead of following the majority of writers, we prefer to adhere strictly to the statement made in the Sūryasiddhānta, according to which the longitude of the junction stars of Revati is not zero but 359^0 50', we are led to 560 AD instead of 572.*

This determination of the beginning of the scientific period of Hindu astronomy has of course always rightly been looked upon as roughly approximative only, since we have no good reasons for believing that the Hindus of that period were able to perform so difficult an operation as the determination of the place of the equinox with great accuracy. That the beginning of scientific astronomy has to be dated back another seventy years at any rate, already follows from the admitted time of Āryabhaṭa alone. That the Siddhāntas on which Varāhamihira drew, among them the old Sūryasiddhānta, was also older than 572, follows from Varāhamihira's own time. Prof. Whitney, who has discussed most thoroughly the bearings of the statements, which the Sūryasiddhānta makes, about the longitudes of the junction stars, points out that if, instead of relying solely on the longitude assigned to Piscium, we compare the longitudes assigned to the junction stars of all the 27 Nakṣatras with their actual longitudes in 560 AD, a certain uniformity of error observable in the statements of the Sūryasiddhānta leads us to suspect that the measurements of position on which the list was established were made from an equinox situated about 1^0 to the

[2] Pañcasiddhāntikā, Edited by G. Thibaut and Mahāmahōpādhyāya Sudhākara Dvivedi, p. LVII – LX of Introduction. Published by Chowkhamba Sanskrit Series, Varanasi, 1968.

east of that of AD 560 and hence at a time preceding the latter date by about seventy years.

At any rate the Sūryasiddhānta supplies us with data enabling us to decide what point of the fixed sphere is supposed to mark the first point of Aśvinī. But these data fail us if we turn to other astronomical works. As we have seen above, the Pañcasiddhāntikā itself, where stating the longitudes of certain junction stars, says nothing about the junction stars of Revatī, and from what it says about other junction stars we are unable to draw any well-settled inferences. But it is of course by no means unlikely that Varāhamihira, whom we suppose to have written the Pañcasiddhāntikā about the middle of the sixth century, should have agreed with the Sūryasiddhānta in giving no or almost no longitude, to the star Piscium.

But what, we must proceed to ask, did Āryabhaṭa, and his predecessors, such as the authors of Romaka and Pauliśa Siddhāntas, understand by the first point of Aśvinī? The Laghvāryabhaṭīyaṃ says nothing about the longitudes of junction stars, and we are therefore unable to determine what point of sphere coincided, in Āryabhaṭa's view, with the first point of Aśvinī. The same remark applies to writers whom we may suppose to have anteceded Āryabhaṭa. That the authors of the Romaka and Pauliśa already treated the first point of Aśvinī as the initial point of the sphere, appears to follow from the Pañcasiddhāntikā; but nothing shows that they supposed the small star Piscium to be situated just at that point. To me it appears most probable that the earliest scientific Siddhāntas used the term the 'first point of Aśvinī' in the same sense as the Greeks used the ' the first point of Aries' viz. to denote, not a fixed place in the sphere, but simply the place of the vernal equinox. From the term, the 'first point of Aśvinī' so much indeed follows that, when it was first coined, the vernal equinox was according to the observation of the Hindu astronomers, somewhere to the west of the asterism Aśvinī and to east of the asterism Revatī; but about the exact point meant to be indicated by that term we know nothing. If indeed the limits of the nakṣatras had been accurately defined already before the period of Siddhāntas, the term 'Aśviny – ādi ' would have from the beginning indicated a definite place in the fixed sphere; but there is nothing to show that that was the case, and, as pointed out by Professor Whitney, it certainly is intrinsically improbable that the small star ζ - Piscium should ever have marked any important point in the sphere before the time when it actually happened to coincide with the vernal equinox. Thus to the author of the Romaka f.i. the term ' the first point of Aśvinī ' may have meant a spot one or two or three or four or five degrees east of ζ - Piscium, any spot indeed lying to the east of the junction star of Revatī and to the west of the junction star of Aśvinī. Later on, let us say about the middle of the sixth century, it was observed that the place of equinox coincided, or nearly coincided, with the junction star of Revatī, and as at that time the fixed sidereal system had exclusively established itself in India, that star has ever since been held to mark the beginning of the sphere. But the earliest testimony we have for this its position is the statement which the Sūryasiddhānta, as known at present, makes about the longitudes of the junction stars, and that statement in no way proves that the same view was set forth in other books of a presumably earlier date.

The preceding remarks merely aim at showing that there is no evidence for the earliest Siddhāntas having identified the place of the vernal equinox with that of Piscium, and that

we hence are not compelled to look for the beginnings of Scientific Hindu astronomy in a period not earlier than the fifth century".

It is pertinent to note that Thibaut had pointed out the mystery of the initial point more than a century before the effort of the Calendar Reform Committee (1955) to precisely define it. Diskhit too attempted to have a grip with the intricacy of the use of sidereal year in conjunction with an equinoctial zero point and this ultimately led him to the wrong realization that the Indian zodiac was originally Sāyana or Tropical. Much discussion on the matter is available in the work of Dikshit and in recent years in the Calendar Reform Committee report and in the recent issues of an ephemeris published from Delhi. By professing a tropical character to the Hindu zodiac these Indian scholars have done more damage to the originality of Hindu astronomy than the Western scholars. The originality of Hindu astronomy is implicit in its sidereal character and as such subscribing the lop-sided view of these modern interpreters poses the danger that it will undermine the originality of Hindu astronomy and shall in turn sabotage the credibility of the indigenous 'nirayana' or sidereal astrology. If Hindu Zodiac is tropical, it is certainly an offshoot of the Greek science and there is absolutely no justification to profess a zero point different from the vernal equinox. Hindu astronomy, zodiac and the related astrological formalism can claim originality only if we can demonstrate the existence of a unique sidereal astronomy and definition of the Hindu zero point 'Aśvinyādi' in pre-Āryabhaṭa times.

2. Originality of Hindu Astronomy and its Sidereal Character

Sūryasiddhānta is believed to be the greatest treatise among those available today as representative of the salient features of Siddhāntic astronomy. In contrast to the Greek science the following distinctive features can be noted.

(a) Length of the solar year is 365.25875 days as against the Ptolemy's value of 365.24666days.

Even though Varāhamihira had given the Ptolemy's value as the year-length of Rōmaka Siddhānta in his work Pañcasiddhāntikā, neither of the later Hindu astronomers gave any cognizance to this near- tropical value. The calendar Reform committee and certain modern astronomers have speculated that the ancient Hindu astronomers were ignorant of the precession of the equinoxes and the length of the tropical year. The fallacy of such inferences can be understood from the following:

Pañcasiddhāntikā III. 34, 35: [Romakamate Doṣaḥ][3]

> Mārgādapetametat kāle laghutā na tāvadatidūre I
> Svaviṣayabhūtāṣṭarasai'rabdaiḥ paśyāƒsya vinipātaṃ II 34 II

"This Romaka has not come down through a hierarchy of good teachers because it follows the Tropical year instead of the traditional sidereal year. It will be exposed in a period of 6855 of its own tropical years and people will abandon it "

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[3] Pañcasiddhāntikā of Varāhamihira, with translation and notes by TSK Sastry and Dr. K.V.Sarma, pp. 71-72. PPST Foundation, Adyar, Madras. (1993).

How this will happen and how the number 6855 can be arrived almost exactly, will be shown in explaining the next verse.

Roumakamahargaṇaṃ vā tadarkaminduṃ ca gaṇayatāṃ grāhyaṃ
Caitrasya pourṇamāsyāṃ navamī nakṣatramādityaṃ II 35 II

"If we adopt the days from epoch resulting from the tropical year as adopted by the Romaka and the Sun or Moon resulting there from, we must accept Puṇarvasu as the nakṣatra of the full moon of the month of Caitra, instead of the expected Hasta, or Citrā, Puṇarvasu which is the nakṣatra of Caitra –Śukḷa – navamī. "

Sidereal offset for Romaka=43"approx. Cumulative effect in 6855 years = $81^0 38"$ = 6 nakṣatras approximately. i.e. Sun will be behind by 6 nakṣatras ($360^0 - 80^0 = 280^0$) and hence Caitra – pourṇami will correspond to the transit of Moon over Puṇarvasu after 6855 years.

Further, Bṛhatsaṃhitā: III. 1 & 2:[4]

Āśḷeṣārdhāddakṣiṇamuttaramayanaṃ raverdhaniṣṭhādyaṃ I
Nūnaṃ kadācidāsīdyenōktaṃ pūrvaśāstreṣu II 1 II

Sāmpratamayanaṃ savituḥ karkaṭakādyaṃ mṛgāditaścānyat I
Uktābhāvō vikṛtiḥ pratyakṣaparīkṣaṇairvyarktiḥ II 2 II

"Certainly at one time the summer and winter solstices were at the middle of Āśleṣā and the beginning of Dhaniṣṭhā respectively, because such has been mentioned in the ancient lore. But now the summer solstice is at the beginning of Cancer and the other one at the beginning of Capricorn. If at any time this is not conformed to, then there is a further change, which can be seen and measured."

From the above it can be inferred that the Hindu astronomers had sufficient reasons to differ from the Ptolemy's value.

(b) According to the Hipparchus's view adopted by Ptolemy the annual shift of the solstices amounted to 36" only. But in India we can find an explicit record of the exact rate of annual precession in Siddhāntic astronomy from AD.932 (Date of Muńjala's Laghumānasaṃ) onwards.

(c) Ptolemy was not aware of the motion of the apsides but all the Hindu siddhāntas invariably give the numbers of revolutions of the apsides in a Mahāyuga, Kalpa etc.

(d) Sidereal periods of Planets except that of Moon are different from those of Ptolemy.

(e) Radii vectors, inclination of orbits, maximum values of the equation of center and annual parallax, Obliquity of the ecliptic, Longitude of the apogees, dimensions of the epicycles are all different from those of Greek system. In the use of epicycles, R-sines

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[4] Bṛhatsaṃhitā, Translation by M.Ramakrishna Bhatt, p.23, MLB, 1986.

(substitution of sines for chords) etc, the Hindu methods are far more superior to that of Ptolemy.

(f) Above all, the Hindu Chronology that we find in all siddhāntic treatises has no parallel in the Greek science.

Modern astronomers tend to believe that the Hindu Chronology is an admixture of the 'absurd imaginations drawn from paurāṇic literature' with the astronomical science. SB Dikshit has made the following observation:

"Although this may be a serious lapse from the European point of view, it is no t so from ours. On the contrary we would rather appreciate the ingenuity that they displayed in reconciling the Yuga system with the hard facts of their science."

Nothing can be far from the truth. There was neither the alleged 'admixture' nor the 'reconciliation'. In fact the Yuga system is an essential ingredient of the siddhāntic methodology as will be shown in a succeeding part. It was only because of their astronomical origin that they could find their way into the siddhāntic literature.

Against these marked variations, which are demonstrative of the indigenous origin and development, the western critics could find certain similarities whose origin could not be ascertained conclusively. For example, Professor Whitney did refer to the sexagesimal arc divisions, similarity in the description of the Zodiac, supposedly Greek terms like lipta, Hora, Kendra etc., theory of epicycles, similarity in astrology etc., but in regard to neither of these he could produce any evidence in favor of the Greek Origin. In the words of Rev. E. Burgess:

"I think he does not give the HINDUS the credit due to them and awards to the Greeks more credit than they are justly entitled to ... in reference to no one of them do the claims of any people to the honor of having been the original inventors or discoverers appear to be better founded than those of the Hindus. Secondly, in reference to most of them the evidence of originality I regard as clearly in favor of Hindus...

In reference to the so called Greek words found in Hindu astronomical treatises I would remark that we may refer them with propriety to that numerous class of words common to the Greek and Sanskrit language which either came to both from a common source or passed from the Sanskrit to the Greek at a period of high antiquity; for no one maintains that the Greek is the parent of the Sanskrit...

As regards the resemblance between the Greek and Hindu methods of calculating the true places of planets, I think that only hints could have passed from one people to the other, and that at any early period; for on the supposition that the Hindus borrowed from the Greeks at a later period, we find it difficult to see precisely what it was that they borrowed; since in no case do numerical data and results in the system of the two peoples exactly correspond, And in regard to the more important of such data and results-as for instance, the amount of the annual precession of the equinoxes, the relative size of the Sun and the Moon as compared with the earth, the greatest equation of the center for the Sun- the Hindus are more nearly correct than the Greeks, and in regard to

the times of the revolutions of the planets they are very nearly as correct. There has evidently been very little astronomical borrowing between the Hindus and the Greeks. And in relation to points that prove a communication from one people to the other, I'm inclined to think that the course of derivation was the opposite to that supposed by Colebrooke - from east to west rather than from west to east; and I would express my opinion in relation to astronomy, in the language which this eminent scholar uses in relation to some coincidences in speculative philosophy and religious dogmas, especially the doctrine of metempsychosis, found in the Greek and Hindu systems, which indicate a communication from one people to the other: "I should be disposed to conclude that the Indians were ,in this instance, teachers rather than learners".

Indian scholars who have tried to defend the originality of the Siddhāntic astronomy did so on fragile grounds without realizing the fundamental sidereal character of Hindu zodiac. In fact the Siddhāntic epicycle astronomy was not the original Indian astronomy at all. As Whitney has noted it was impossible for such an arbitrary scheme to develop independently and simultaneously at two different places. Indians certainly took the hint of the epicycle theory from Apollonius and applied the concept to their sidereal zodiac in the original Sūryasiddhānta that had become probably non-extant by the time of Varāhamihira as noted by S.B. Dikshit. We shall attempt a demonstration of this fact later on by bringing out the true physical and mathematical rationale of the sidereal zodiac implicit in Sūryasiddhānta. Instead of defending what was fundamentally Indian original we have tried in the past to make a claim over the epicycle theory and that effort has failed as is evident from the predominant thinking in favor of the Greek origin. Features outlined above that tend to give a color of originality to the Hindu science arise out of the ingenious application of the epicycle model on to the sidereal zodiac. It is not the result of an original and independent development of epicycle astronomy. Even though oriental scholars like S.B. Dikshit has tried to prove that the Siddhāntic astronomy is an original development, they could not hold their ground against the mesmerism created by the seven-day week and the Hora. In explaining Hora every one failed to take note of the Sanskrit equivalent of Horizon viz., "Hari-jam" as can be seen in Sūryasiddhānta V.1, Pańcasiddhāntikā XIV.17 etc. In Bṛhatjātaka V.17 'Harijaṃ' has been used in the precise sense of 'rising point' or Hōra and as such the etymological origin of both can be traced to the synonym of Sun as Hari - Time, the destroyer. Further, in the ' very citadel of Roman Calendar' we can find: Kālāntharaṃ → Calendar; Saptāṃbaraṃ → September; Aṣṭāṃbaraṃ → October; Navāṃbaraṃ → November and Daśāṃbaraṃ → December (10th division of sky). The Roman calendar originally had only ten months from March to December and hence the origin of these terms cannot be different. Does this not reflect that the Hindu wisdom reined over Rome even before the days of Caesar?

- What were the essential features of that wisdom? Where did the zodiac and astronomy originate?
- What forms or where is the real Indian signature in astronomy and astrology?

There's only one answer to these questions and that will dispel all the doubts about the origin and early development of astronomy and astrology. That is, Rāśi Cakraṃ or Rāhu – Śikhi Cakraṃ, original Indian zodiac has a meaningful name that attests its originality, a fact that has remained buried under eons of time and hitherto unknown to the modern world.

As early as the 7th century the Syrian astronomer-monk Severus Sebokht wrote:

"I shall not now speak of the knowledge of the Hindus... of their subtle discoveries in the science of astronomy- discoveries even more ingenious than those of the Greeks and Babylonians- of their rational system of mathematics, or of their method of calculation which no words can praise strongly enough- I mean the system of using nine symbols. If these things were known by the people who think that they alone have mastered the sciences because they speak Greek they would perhaps be convinced, though a little late in the day, that other folk, not only Greeks, but men of a different tongue, know something as well as they".

These words, I hope, shall serve as an eye-opener to all those who have professed a Greek parentage for the astronomical science - the Vedic discipline of Jyotiḥśāstra.

3. Rationale of the Yugas

Manusmṛti, Mahābhārata and the Purāṇas postulate the operation of a cycle of Yugas over the terrestrial existence. These incomprehensibly larger periods of time have an astronomically defined beginning or zero of Time 'Brahmā' who had his mythological birth in Rōhiṇī nakṣatra. Simultaneously the Kalpa, Manvantara and the Mahāyuga cycles get initiated – the Kālacakra manifests with the schedule:

Mahāyuga: 12000 divine years = 4320000 solar years

[Has four components in the ratio 4:3:2:1]

Yugapādaṃ	Divine years	Solar years
Kṛta	4800	1728000
Tṛetā	3600	1296000
Dvāpara	2400	864000
Kali	1200	432000
Manvantara:	72 Mahāyugas	71 as per Mahābhārata
Kalpa	14 Manvantaras	Day of Brahmā
Brahmā – Year:	720 Kalpas	31104* 10^8 years
Brahmāyu	100 or 120 years	72000 or 86400 Kalpas

In this cycle, the present world belongs to the IInd Parārdha (51st year) of Brahmā, Śṛī Śveta -varāha Kalpa, Vaivasvata Manvantara, 28th Mahāyuga and Kaliyuga. The basic unit of this wheel of time is the Kaliyuga and the beginning and end of such a period is astronomically identifiable by super-conjunctions of the 'Aṣṭa-Grahas' at the Hindu zero point Aśvinyādi. The last such beginning according to Āryabhaṭa took place on the mid-

night of Thursday, 17-18 February 3102 BC, when the Mean Sun became zero along with other Mean longitudes of Planets.

All the Hindu astronomical Siddhāntas have been created over this fundamental premise but without crediting any physical rationale to these 'monstrous chronological periods'. Even the smallest of them '432000' is incomprehensibly larger and is of no practical utility in the astronomical computations. Moreover from the modern astronomical view Kaliyugādi is only an arbitrary epoch! In the last 1500 years since the time of Āryabhaṭa, astronomers had to generate many different successive epochs to maintain accuracy in the computations - then what to speak of the utility of an epoch that was 3600 years behind for Āryabhaṭa?

•Under these circumstances, how could such numbers make their entry into the Hindu psyche?

It is quite unlikely that as Prof. Whitney pointed out it is a lump of 'mythological non-sense'. On the contrary these numbers may contain some hitherto unknown rationale that remains to be explored. The predominant view is that the Hindu astronomical beginning of Kaliyuga was the result of a back calculation wrong in its data, and was thus started wrongly. The multitude of other cycles represents the eternity of time and is not of any astronomical significance. In contrast to such perceptions a novel interpretation exclusively dependent upon Siddhāntic astronomy is attempted below.

• Siddhāntic Methodology Implicit in the Cycle of Yugas

(a) **Unit of Saura - dina**

360 'days' of the divine year constitute the year of Brahma. Obviously the reference is to solar degrees while considering the terrestrial year and solar revolutions in the context of the divine year. Similar expression of the synodic periods can be noted in the Panchasiddhantika:

Planet	Synodic Period of Pańcasiddhāntikā	Converted into Synodic days	Modern values.
Mars	768 3/4	779.979	779.936
Mercury	114 6/29	115.875	115.878
Jupiter	393 7/1	398.885	398.884
Venus	575 1/2	583.901	583.921
Saturn	372 2/3	378.110	378.092

Dr.Thibaut, despite his scholarship in the Greek & Babylonian sciences, could not decipher the Siddhāntic cryptogram of column (1). Is this not a sufficient evidence for the originality of the Hindu methods?

(b) **Computation based On the Synodic Periods**

Even though the Siddhāntas depict the mean motions of the Planets in terms of the integral number of sidereal revolutions in a Kalpa or Mahāyuga, Pañcasiddhāntikā, chapter XVIII suggests the use of synodic observations and periods in the formulation of the treatises. The process of derivation of the mean elements can be visualized as:

Siddhantic length of the solar year = 365.25875 days [**Y**]
Synodic period in sāvana days = S^d
S in units of Sauradina = $360.S^d/Y = S^0$

Now, the annual synodic variation of longitude or planetary motion relative to sun (**Y/*S*** or $360/S^0$) expressed in degrees automatically represents the integral number of synodic revolutions in a smaller Yuga of 360 years. That is:

$(Y/S)^0$ =Integral number of Synodic revolutions in 360 years (n_{360})
$(Y/S)' = n_{21600}$ and $(Y/S)'' = n_{1296000}$

As corollaries the synodic variation or elongation of planets corresponding to the solar arc 1^0 *expressed in degrees constituted the Integral number of synodic revolutions of a solar* year. If the above is expressed in seconds of arc it represents the '**n**' over 3600 years. Similarly $(Y/S)''$ in one solar minute = $n_{60\ years}$ and $(Y/S)''$ over one solar second = $n_{1\ year}$.

Alternatively,

$(Y/S)^0 = n_{360}$ & **N** = 360 – **n**, Where **N** is the integral number of sidereal revolutions of the planet in 360 solar years. [$10^*(Y/S)^0 = n_{3600}$ and **N** = 3600 - **n**]. It is apparent therefore that the conversion of divine year into solar years is only a mythological adaptation of the process of derivation of the integral number of synodic revolutions.

If we take the epoch of Āryabhaṭa viz., 3600 years of Kaliyuga as an example, it can be seen that the synodic variation of Planets over a degree longitude of Sun or Sauradina represented the synodic revolutions of 3600 years numerically, when expressed in seconds of arc. Tc determine the integral number of revolutions over a Mahāyuga of 4320000 years Siddhāntic astronomy required only the planetary elongation over 1200 degrees of solar movement. It must be noted that this is the maximum limit of observational period, which can be reduced to 120 degrees of solar arc by involving the multiplication factor of 10. Or by using the annual synodic variation (Y/S)" (expressed in seconds) **n** & **N** could be obtained for 1296000 years - a period three times the basic unit of Kaliyuga.

4. Synodic Super-conjunction Of Kaliyugādi

Āryabhaṭa is the first among human authors who have made use of the purāṇic speculation of the beginning of Kaliyuga in his astronomical treatise. According to the Ārdharātrika system of Āryabhaṭa, a synodic super-conjunction of the planetary mean longitudes at the Siddhāntic Meṣādi marked the beginning of Kaliyuga on the midnight of 17/18 February 3102 BC for the meridian of Ujjain. But with the modern astronomical equations for the planetary mean elements scholars have proved that no such super-conjunction did really occur at the above epoch. In the light of this evidence, another line of inquiry opens up as regards the 'kind of errors' that led the early Siddhāntic astronomers to the discovery of a solely 'computational' mean conjunction of the planets. How can the errors in the observationally determined mean elements of all planets were such that the mean longitudes converge to zero on computing back for 3600 years, with reference to the epochal positions of Kali 3600(elapsed) or the vernal equinox of AD 499?

In contradiction to the scientific spirit evident in the works of Āryabhaṭa, certain scholars have credited him with the incorporation of the 'speculative' Yuga concept into mathematical astronomy. To quote, Roger Billard:

"Not only did Āryabhaṭa construct Yuga upon such beautiful reduction of observations, but I must add that almost certainly the great astronomer is responsible for the very construction of the Yuga speculation into mathematical astronomy."

This observation is erroneous in view of the reflection of Siddhāntic methodology visible in the conversion of the divine year into solar years and the use of 'Sauradina' for defining the year of Brahmā. It is apparent that the Yuga system evolved as a consequence of the Siddhāntic practice rather than the incorporation of an alien imaginary concept into the computational frame of astronomy. Further any such incorporation would have demanded alteration of the observational values quite against the scientific convictions. The values of mean sidereal day (= $23^h 56^m 4.1^s$), value of π (=3.1416) and the theory of earth's rotation and revolution round the sun provide ample testimony for Āryabhaṭa's pledged affiliation to scientific approach and as such he would not have resorted to any arbitrary modification 'to escape from the stigma of anti - Vedic heresy'. In fact, no evidence is forthcoming from his treatise to allege a fascination for purāṇic ideas over the scientific spirit. Against the background of the above discussion, it can be stated by borrowing the words of Prof. Whitney that *the scientific habit of mind perceivable in Āryabhaṭa would not have permitted the admixture of the astronomical science with the absurd imagination drawn from Purāṇic literature.* It is therefore likely that Āryabhaṭa's adherence to the epoch of Kaliyugādi may be due to some hitherto unknown astronomical reasons.

• Super-conjunction as a Consequence of Siddhāntic Methodology

Earlier in the discussion we saw that the Pañcasiddhāntikā Chapter XVIII suggests the use of synodic periods in the Siddhāntic computations. This is further supported by the observation of Rev. E. Burgess in his translation of Sūryasiddhānta - the Siddhāntic practice of applying bījā involved only the correction to the elongation errors untouched. It is apparent therefore that the mean Sun corresponding to the expiry of the respective Kali

year was the zero point of Siddhāntic astronomy and as such the other mean longitudes could be computed by the use of their synodic periods. Dr. Arka Somayaji has also expressed a slightly different view that the sidereal periods which require observations of longer periods like 30 years in the case of Saturn, might have been derived from the synodic periods by the use of the relation:

$1/S = 1/T \sim 1/Y$ (S=Synodic period, T= Sidereal period & Y= Length of the solar year)

Further, the Mahāyuga being the interval between two synodic super-conjunctions, corresponding to the integral numbers of sidereal revolutions visible in the Siddhāntas, there must be the integral numbers of synodic revolutions also. Based on Sūryasiddhānta Chapter I, śḷōkas 34 & 35 it can be inferred that the Siddhāntic astronomers knew the following relation:

$Y/S = 1 \pm N/4320000$, where **N** is the integral number of sidereal revolutions in 4320000 years. Alternatively, $N=(1\pm Y/S)*4320000$, (-) for the superior and (+) for the inferior planets.

Explanation for Synodic Super-conjunction

Let **D** be the number of days in which there in **n** synodic revolutions. The synodic period ***S*** can be then expressed as:

$$S = D/N$$

The maximum possible elongation = 180^0 = 1/2 synodic revolution.

When 'n' =====> 'n+1/2', above equation can be re-written as $S^* = D/(n+1/2)$

Now, $S - S^* = D/n - D/(n+1/2) = D/2 \div /(n^2+n/2)$.

This equation gives the variation in the synodic period on accounting an elongation of 180^0 in computation over '**D**' days. It is apparent that $(S - S^*)$ tends to zero when n^2 becomes large as compared to '**D/2**' i.e. the elongation between the Sun and the Planets become zero while computing between two distant epochs using the synodic periods and as such computationally the synodic super-conjunction was a reality for the Siddhāntic astronomers.

Further the expression suggests that the Siddhāntic synodic period will be closer to it's modern true value in the case of planets for which '**n**' is a maximum i.e. the Siddhāntic synodic periods will be more accurate in the order Mars, Venus, Jupiter, Saturn, Mercury and the Moon in view of the increasing order of the integral number of synodic revolutions in a Mahāyuga. Alternatively accuracy of the Siddhāntic synodic periods increase in the decreasing order of the synodic periods i.e. from Mars to Moon as mentioned earlier.

The consequence of the use of inexact synodic periods in computation can be illustrated by taking the specific case of Jupiter: $(S-S^*)$ for 1/2 synodic revolution increment in 3600 years = 0.0605 days = 87 minutes i.e. if the synodic period of the Siddhāntas differed

from its true value by 87 minutes, the longitude of Jupiter varies by 180° while computing across 3600 years. At the beginning of Kaliyuga the elongation of Jupiter was only 17° and this small difference automatically cancel out for a difference of 8^{min} 13^{sec} in the synodic period. Similar is the case with all planetary mean longitudes at the beginning of Kaliyuga. Alternatively using the annual synodic variation **Y/S**:

Planet	Siddhāntic **Y/S**	Modern **Y/S**	Difference
Jupiter	329° 38' 54"	329° 39' 1".47	-7".47
Saturn	347° 47' 10".8	347° 46' 43".1	+27".7

The difference in Siddhāntic **Y/S** leads to a variation of (-)7°.47 and 27°.7 for Jupiter and Saturn respectively in 3600 years. Because of this reason Jupiter and Saturn had the above deviations at the beginning of Kaliyuga from the Siddhāntic zero point viz., the vernal equinox of AD 499 for the Ārdharātrika system of Āryabhaṭa.

•• Yuga System - A Mathematical Model

Correlation between the inaccuracy of the Siddhāntic synodic periods and the elongation of the planets at the beginning of Kaliyuga suggest that the Siddhāntic mean planetary elements all are entirely theoretical in origin. Even though such an inference is contrary to what we may expect, it can be satisfactorily explained as follows:

Accuracy of the planetary computations depends upon the precision with which the epochal positions have been observationally ascertained and on the correctness of the planetary motion. As we saw earlier, the methodology of Siddhāntic astronomers demanded the most precisely determined synodic periods for arriving at the correct planetary elongation with reference to the mean Sun of the respective expiry of Kali-year. In this context, the theoretical values based on the Yugādi synodic super-conjunction was probably more reliable than the observationally determined synodic periods i.e. the interval between two successive heliacal risings or settings. For example, Āryabhaṭa himself accepted the theoretical values as they were providing the best fit with the observations as compared to the observationally deducible crude values of such distant past. It is quite likely that the ancient astronomers had no sufficient provisions for determining the interval between two successive heliacal risings with the accuracy up to the minutes.

5. Epoch of Siddhāntic Astronomy and Zero point

Expiry of the 3600 Kali years is the well-known epoch of Āryabhaṭa in the 'Midnight' as well as 'Sunrise' systems. It can be understood by computation and from the quotations of Bhāskara-I that the year-length of the 'midnight' system was 365.25875 days - the same as that of the 'old' Sūryasiddhānta available in Pañcasiddhāntikā. In view of this agreement it is generally accepted that the expiry of 3600 Kali (Śaka 421) is the epoch of Sūryasiddhānta as well. The epochal positions according to the Āryabhaṭīya are given in the following table:

Mean Longitudes of Planets at 3600 Kali (elapsed)

(21st March 499 AD, 1200 LMT, Ujjayini)

Kalidina = 1314931.25: JD[TDT] = 1903396.8432

Planets	Mean longitudes	
	Āryabhaṭa	Modern astronomy
Sun	0^{0}	$359^{0}45'$
Moon	$280^{0}48'$	$280^{0}48'$
Node	$352^{0}12'$	$352^{0}01'$
Apogee	$35^{0}42'$	$35^{0}26'$
Mars	$07^{0}12'$	$06^{0}55'$
Merc.	$186^{0}00'$	$183^{0}23'$
Jupiter	$187^{0}12'$	$187^{0}09'$
Venus	$356^{0}24'$	$356^{0}14'$
Saturn	$49^{0}12'$	$48^{0}23'$

It must be noted here that the vernal equinox of AD 499 or K_{3600} was 15 minutes of arc west of the mean sun of Āryabhaṭīya rather than being both coincident. The Siddhāntic Aries ingress as such coincided with the tropical Aries ingress only in A. D. 522 (Śaka 444) or K_{3623}.The zero precession years of the later 'Karaṇa' works like Rājamṛgāñka. Karaṇapṛakāśa, Karaṇakutūhala (Śaka 445) etc., substantiate this point. Further, the Kerala School of astronomy traditionally considers Kali 3623(elapsed) as the epoch of Āryabhaṭīya. Thus the identification we receive for the zero point of the Siddhāntic zodiac from an analysis of the epochal positions of the earliest available treatises is the vernal equinox of AD 499 or AD 522.

An alternative approach is to look for a fiducial star – a reference star representing some cardinal longitude – in the Siddhāntic astronomical treatises. The Calendar Reform Committee under the chairmanship of Dr. Meghnad Saha made serious efforts in this direction, but the committee could arrive at only an arbitrary, dubious solution. In our quest for the real Hindu Zodiac or 'Rāśicakra' a glance over the pitfalls that they have encountered may be of much guidance – especially to forebode us from such lapses. For a real grasp of the intricacy involved we need to know also about the circumstances and factors that led to the inquest of Siddhāntic astronomy in search of its zero point.

The Siddhāntic Pañcāñgas were prevalent all over India in its haphazard variety till the advent of modern European Tables by the middle of the nineteenth century. Indigenous use of these more accurate tables for astrological purposes demanded reconciliation between the European and Siddhāntic zero points. European zero reference was always the regressing vernal equinox, but as regards the Siddhāntic reference no clear answer was forthcoming from the multitude of texts credited to different Ācāryas. In the words of an oriental scholar:

"No definite indication is available in either of the Siddhāntas regarding the fixed initial point and it appears that at different periods of our Calendaric History different initial points were adopted as the reference".

This unfortunate situation led to the rise of different schools of thought as to where really is the location of the initial point? The scenario reminds us of the story of four blind men who had gone to see the elephant! With little consideration for objectivity and scientific approach many different self-styled Godfathers of astrology chose to father an 'ayanāṃśa' (a technical synonym for the initial point) relying on their limited subjective experience with the horoscopes derived one way or the other from the European longitudes. The vexed question of 'ayanāṃśa' soon took the shape of a controversy and it still looms large over the astrological intelligentsia, at the close of the twentieth century. An overview of the different such hypotheses shall be attempted in the next section.



IV

AYANĀṂŚA

"No scientific investigation is ever complete in itself. It acquires meaning only thanks to the work of predecessors and followers. If science is compared with a great building, then an individual research is a brick in its wall".

"We are in the middle of a race between human skill as to means and human folly as to ends. Given sufficient folly as to ends, every increase in the skill required to achieve them is to the bad. The human race has survived hitherto owing to ignorance and incompetence; but given knowledge and competence combined with folly, there can be no certainty of survival. Knowledge is power, but it is power for evil just as much as for good. It follows that, unless men increase in wisdom as much as in knowledge, increase of knowledge will be increase of sorrow"

Bertrand Russell (The Impact of Science on Society, pp. 120 -121)

"The present state of the system of nature is evidently a consequence of what it was in the preceding moment, and if we conceive of an intelligence which at a given instant comprehends all the relations of the entities of this universe, it could state the respective positions, motions, and general effects of all these entities at any time in the past or future. Physical astronomy, the branch of knowledge which does the greatest honor to the human mind, gives an idea, albeit, imperfect, of what such an intelligence would be. The simplicity of the law by which the celestial bodies move, and the relations of their masses and their distances, permit analysis to follow their motion up to a certain point and in order to determine the state of the system of these great bodies in past or future centuries, it suffices for the mathematician that the position and their velocity be given by observation for any moment in time. Man owes that advantage to the power of the instrument he employees and to the small number of relations that it embraces in its calculations. But ignorance of the different causes involved in the production of events, as well as the complexity, taken together with the imperfection of analysis, prevents our reaching the same certainity about the vast majority of phenomena. Thus there are things that are uncertain for us, things more or lese probable, and we seek to compensate for the impossibility of knowing them by determining the different degrees of likelihood. So it is that we owe to the weakness of the human mind one of the most delicate and ingenious of mathematical theories, the science of chance or probability"

Laplace, 1776

IV

AYANĀṂŚA

1. Ayanāṃśa Controversy

• What is 'ayanāṃśa'?

The heliocentric orbits of all planets lie approximately in the same plane as that of earth and hence to an observer on earth all of them apparently traverse a celestial zone extending to a width of about 8 degrees on either side, of the ecliptic. This celestial belt circumscribing our existence is called as the zodiacal circle or Rāśicakra. The measurement of celestial longitudes is made along the ecliptic, which is a great circle of the celestial sphere. The ecliptic and the equator intersect at two points viz. the vernal equinox and the autumnal equinox which respectively mark the entry of Sun into northern and southern hemisphere. The vernal equinox is the conventional reference point for measurement of celestial co-ordinates, and is generally referred as the first point of Aries. Due to luni-solar forces acting on the axis of earths rotation and the consequent precession of axis the equator shifts parallel to itself keeping its inclination to the ecliptic a constant. As a result the equinoctial points undergo a retrograde motion known as the precession of equinoxes. Modern astronomy and the Western astrology make use of this regressing initial point as their reference while in the formulations of Hindu astrology, zodiac has a fixed initial point of reference that is tied upon to the stellar background. According to convention the Hindu's Wheel of Time is therefore permanently linked up with the twelve prominent constellations of the background, which divide the zodiac among themselves into 12 signs of 30 degrees each, having distinct characteristic features. These zodiacal signs have been named after the imaginary figures with which the constellations resembled like 'The Ram', 'The Bull' etc. To accomplish the permanent tie up with the constellations it is therefore necessary to correct the modern astronomical longitudes for the cumulative amount of precession since the days of the original coincidence of the vernal equinox and the initial fixed reference point of Aries. This angle over which the vernal equinox has receded from the Aries 0^0 is known as the *ayanāṃśa*.

But unfortunately no one knows the time of coincidence of both the tropical (Sāyana or the receding) zodiac and the (Nirayana or the fixed) sidereal zodiac. There are many different schools of thoughts, and their vociferous advocates... but till date the controversy remains unresolved... If you have a loose brain that defies the commonsense you can have your own ayanāṃśa.

•• The popular viewpoints

(a) Citrāpakṣa

This is the basis of the National Calendar as per the recommendation of the Calendar Reform Committee and is the most widely accepted. In this conception Citrā (α-Virginis), defined to be of sidereal longitude 180^0 is the fiducial star, and the tropical as well as sidereal zodiacs coincided in the year 285 AD.

(b) Revatīpakṣa

Revatī (ζ - Piscium) assumed to be of sidereal longitude 360^0 is the fiducial star. B.G. Tilak had been a follower of this school. Zero precession year is AD 576.

(c) Dr. B.V. Raman's ayanāṃśa

Rest upon the supposition that the ayanāṃśa of Bhāskara-II was correct for his epoch. Cumulative precession since that time is computed at the rate of 50"-1/3 per year. Bhāskara's ayanāṃśa (Kali 4284) = 11^0.

Raman's ayanamsa (**K**) = $11^0 + (\mathbf{K} - 4284) \times 50.333''$ where **K** is the Kali year for which ayanāṃśa is required.

(d) K.S. Krishna Murthy's ayanāṃśa

Values are less than Citrāpakṣa by roughly 6'.

(e) Cyril Fagan & Donald A. Bradley (Western Siderealists)

Rōhiṇī (Aldebaran) supposedly occupying the middle of Vṛṣabha i.e. sidereal longitude of 45^0 is the fiducial star. After many experiments Bradley's final choice was AD 220 as the zero precession year.

(f) Devadatta Ayanāṃśa

Born out of the intuitive perception of Svāmi Sadāśiva Giri, the values are simply 22' 37" less than the Citrāpakṣa value. Sri. K. N. Rao I.A.A.S (retd.) and Prof. P.S. Sastry have described the work as a significant piece of research.

Apart from these we have got the Siddhāntic ayanāṃśas of Sūryasiddhānta, Grahalāghava etc. and many other spurious values. The funniest aspect of this enigmatic issue is that all these godfathers of astrology claim that their value is the 'true' one and others are false, because of the scientific arguments and their so and so correct predictions. The astrologer's community today appears to be a mental asylum in view of these conflicting arguments. Divisional charts are correct, Udu & Kālacakra daśa computations are precise... there are infinite claims of brilliance. All these invariably

suggest that none of them is correct. Had any one been correct, others would have faded away in due course.

Indian Astronomy thus finds itself as originating out of a 'mystery' regarding its zero point on the ecliptic and the many different schools of ayānamśa obviously mean different horoscopes for the same individual and different calendars for religious observances. India had more than thirty regional calendars prevalent at the time of independence and hence the need was felt for a uniform National Calendar. To resolve the above 'mystery' as well as to get rid of the multitude of in-congruities prevailing with the regional calendars of India the Government of India appointed a Calendar Reform Committee under the chairmanship of Prof. Meghanad Saha in November 1952. The Committee was entrusted with the task of examining all the existing calendars, which are being followed in the country at present and after a scientific study of the subject submit proposals for an accurate and uniform calendar for the whole of India. The following were the members of the committee:

Prof. MN Saha D.Sc FRS. MP (Chairman)
Prof. AC. Banerji, Vice-Chancellor, Allahabad University
Dr. KL Daftari, Nagpur
Sri. JS Karamdikar, Ex-Editor, The Kesari, Poona
Dr. Gorakh Prasad, D.Sc., Allahabad University
Prof. RV Vaidya, Madhav College, Ujjayini
Sri. NC Lahiri, Positional Astronomy Centre, Calcutta. (Secretary)

Dr. Gorakh Prasad and Shri. N.C. Lahiri came in place of Prof. SN. Bose and Dr. Akbar Ali who were originally appointed but were unable to serve. The Committee's report was submitted to CSIR in 1955 and the Government accepted the recommendations of the committee with effect from 21st March 1956 AD.

2. CRC Report - A Discussion

• Intricacy of the Nakṣatras (Lunar Mansions)

(CRC report page 183)

"Many ancient nations developed the habit of designating the day-to-day (or night-to-night) position of the Moon by the stars or star-clusters it passed on successive nights. The number of such stars or star-clusters was either 27 or 28; the ambiguity was due to the fact that the mean sidereal period of the Moon is about 27-1/3 days, the actual period having a variation of seven hours, and the ancients who did not know how to deal with fractions, oscillated between 27 and 28. In India, originally there were 28 nakṣatras, but ultimately 27 were accepted as the number of lunar asterisms.

... Names of certain 'nakṣatras' are found in the oldest scriptures of India, viz., the Ṛgveda, but a full list is first found in the Yajurveda. In the older classics of India (the Yajurveda, the Mahābhārata), the nakṣatras invariably start with Kṛttikās, the Pleiades; the supposition has been made that the Kṛttikās were near the vernal point, when this

enumeration was started.... Later during Siddhānta Jyotiṣa times the enumeration started with Aśvinī (α, β Arietis) and this is still reckoned to be the first of the nakṣatras, although the vernal point has now receded to the Uttarabhadrapāda group, which should accordingly be taken as the first nakṣatra. But the change has not been done because the Indian astrologers have failed to correct the Calendar for the precession of equinoxes.

The Chinese start their Hsius (lunar zodiac) with Citrā or α -Virginis. This refers probably to the time when α - Virginis was near the autumnal equinoctial point (285 AD.). The Arabs start their Manzils with β Arietis (Ash-Sharatani). There has been a good deal of controversy regarding the place of origin of the lunar zodiac. Many savants were inclined to ascribe the origin of the 27-nakṣatra system to ancient Babylon, like all other early astronomical discoveries. But as far as the authors of this book are aware, there is no positive evidence in favor of this view. Thousands of clay tablets containing astronomical data going back to 2000 BC, and extending upto the first century AD. have been obtained, but none of them are known to have any reference to 27 or 28 lunar mansions.

... No body has yet been able to refute yet Max Muller's arguments in favor of the indigenous origin of the Indian nakṣatra system given in his preface to the Ṛgveda Saṃhitā, page xxxv. It should be admitted that the lunar zodiac was pre-scientific. i.e., it originated before astronomers became conscious of the celestial equator and the ecliptic, and began to give positions of stellar bodies with these as reference planes. The nakṣatras give very roughly the night-to-night position of the Moon, by indicating its proximity to stars and star groups. Many of the Indian stars identified as nakṣatras are not at all near the ecliptic or the Moon's path, which on account of its obliquity, is contained in a belt within $\pm 5^0$ of the ecliptic. Such are for example:

(15) Svāti, which is identified with Arcturus (α-Bootis), which has a latitude of 31^0 N.
(22) Śṛāvaṇa, identified with α, β, γ Aquilae, having the latitude of 29^0N.
(23) Śṛaviṣṭhā, identified with α, β, γ, δ Delphini, having the latitude of 33^0 N.
(24) Pūrva-Bhadrapāda identified with α - Pegasi and some other adjacent stars, α - Pegasi having latitude of 19^0 N.

At one time the brilliant star Vega (α - Lyrae) was also included making 28 nakṣatras. But this has a latitude of 62^0 N and was later discarded. No satisfactory argument has been given for the inclusion of such distant stars in the lunar zodiac...As is apparent from Table No. 5, the nakṣatras are at rather unequal distances, i.e. they rarely follow the ideal distance of $13^0\,{}^1/_3$. This is rather inconvenient for precision time reckoning. We find in the Vedāṅga Jyotiṣa times an attempt at a precise definition of the two limits of a nakṣatra, which was defined as 800' (=$13^0$20') of the ecliptic. The nakṣatra was named according to the most prominent star (Yogatāra) contained within these limits. These are given in Col. 2 of Table 5.

We do not, however, have any idea as to how the beginnings and endings of the nakṣatra divisions were fixed in India. The prominent ecliptic stars which were used as Yogatāras (junction-stars) in pre-Siddhāntic period, are not distributed at regular intervals along the ecliptic; and so it was found very difficult to include the stars in their respective equal

divisions ... (if we consider the Star α - Virginis as occupying the midpoint of the Citrā division) ... It seems that a few of the Yogatāras, viz., Ārdṛa, Svātī, Jyeṣṭhā, Pūrvāṣāḍhā, Uttarāṣāḍhā, Śṛāvaṇa and Dhaniṣṭhā fall outside the nakṣatra division of which they are supposed to form the Yogatāra. Matters do not improve much, if we shift the beginning of each division so as to place ζ -Piscium (Revatī) at the end of the Revatī division or in other words at the beginning of the Aśvinī division. This will mean that the position of the star in the nakṣatra division will then have to be increased by 03^0 59', which will push up the Yogatāras of Aśvinī, Bharaṇi, Kṛttikā, Puṣya, Hasta, P. Bhadrapāda and U. Bhadrapāda, Aśvinī. In fact no arrangement at any time appears to have been satisfactory enough for all the Yogatāras to fall within their respective nakṣatra divisions. The divisions of nakṣatras shown in the table, as already stated, have been based on the assumption that the star Spica occupies the 180^{th} degree of the lunar Zodiac. This arrangement agrees with the statement of the Vedāñga Jyotiṣa that the Dhaniṣṭhā star (α or β Delphini) marked the beginning of the Dhaniṣṭhā division, and also of the Varāha's Sūryasiddhānta that Regulus (α - Leonis) is situated at the 6^{th} degree of the Maghā division".

The last words may appear quite logical and scientific to those who are unaware of the contradictions that lie behind. Moreover, the above paragraph beginning with "We do not however gave any idea as to how...." may inspire anyone to appreciate the frankness that Dr. Saha and N. C. Lahiri have displayed in admitting their ignorance. It is apparent that the Committee consisting of the premier scientists and astronomers of India were ignorant of the method of division of the ecliptic into 27 nakṣatra divisions and but still they could recommend a 'scientific' definition of the lunar zodiac – How?

CRC report page 262:

"The zero-point of the Hindu zodiac: By this is meant the Vernal Equinoctial Point (first point of Aries) at the time when the Hindu savants switched on from the old Vedāñga Jyotiṣa calendar to the Siddhāntic calendar (let us call this the epoch of the Siddhānta – Jyotiṣa or S.J). There is a wide spread belief that a definite location can be found for this point from the data given in the Sūryasiddhānta and other standard treatises. This impression is however wrong. Its location has to be inferred from the co-ordinates given for known stars in Chapter VIII of Sūryasiddhānta. From these data Dikshit thought that he had proved that it was very close to Revatī (Zeta Piscium); but another school thinks that the autumnal equinoctial point (first point of Libra) at this epoch was very close to the star Citrā (Spica, α – Virginis) and therefore the first point of Aries at the epoch of S. J. was 180^0 behind this point. The celestial longitude in 1950 of ζ - Piscium was 19^0 10' 39" and of α - Virginis was 203^0 08' 36". The longitudes of the first point of Aries, according to the two schools therefore differ by 23^0 09'(-) 19^0 11' = 3^0 58' and they cannot be identical. Revatī or ζ - Piscium was close to γ_o (the V. E. point) about 575 A. D. and Citrā or α -Virgins was closest to Ω_o (the A. E. point) about 285 A. D., a clear difference of 290 years.

Thus even those who uphold the Nirayana School are not agreed amongst themselves regarding the exact location of the vernal point in the age of the Sūryasiddhānta and though they talk of the Hindu Zero-point, they do not know where it is. Still such is the

intoxication for partisanship that for 50 years, a wordy warfare regarding the adoption of the Hindu Zodiac has gone on between the two rival factions known respectively as the Revatīpakṣa and Citrāpaksa, but as we shall show the different parties are simply beating about the bush for nothing.

Chapter VIII of the S. S. gives a table of the celestial co-ordinates (Dhṛuvakā and Vikṣepa) of the junction stars (identifying stars) of 27 asterisms forming the Hindu lunar zodiac. It is agreed by all that these co-ordinates must have been given taking the position of the V.E. point at the observer's time as the fiducial point. It is possible to locate it, as Burgess had shown in his edition of the S.S., if with the aid of the data given, λ, i.e., celestial longitude of the junction-stars in the epoch of S. J. is calculated and compared it with the λ of the same stars for 1950. Let the two values of λ be denoted by λ_1 and λ_2, λ_1 being the value at the epoch of S.J., λ_2 for the year 1950. Then $\lambda_2 - \lambda_1$ should have a constant value, which is the celestial longitude of the V. E. point at the epoch of the S. J. on the assumption that they refer to observations at a definite point of time...."

By following the method of Burgess, CRC analyzed the polar longitudes and latitudes of Sūryasiddhānta by computing as above the longitudinal difference λ_2-λ_1 and the latitudinal difference β-β' (β is the celestial latitude while β' is the converted S. J. value of the Vikṣepa) and observed that:

"... It is evident that β - β' ought to be zero for all stars, which is however not the fact as may be seen from the table. In the time of the S.S., the observations cannot be expected to have been very precise. But yet we cannot probably hold that an identification is correct when the difference is too large. We are therefore rejecting all identifications where β - β' exceeds 2^0. Probably these stars have not been correctly identified from the description given for them, or the co-ordinates given in the Sūryasiddhānta were erroneously determined or wrongly handed down to us. In the case of other stars, we find that $\lambda_2 - \lambda_1$ is 16^0 47' (or 10^0 52'), 16^0 58' and 26^0 18' for three stars. We are also rejecting these three identifications. This leaves us with the identification of 16 stars as somewhat certain. The values of $\lambda_2 - \lambda_1$ are in three groups as follows.

Group 1	**No:**	$\lambda_2 - \lambda_1$	**Average**
	2 Bharani	22^0 53'	
	8	22^0 01'	22^0 33'
	9	22^0 57'	
	14	22^0 21'	

Group 2	1	22^0 16'	
	3	22^0 10'	
	4	22^0 57'	
	10	22^0 08'	20^0 48'
	12	22^0 47'	
	21	21^0 18'	
	24	21^0 02'	

Group 3	7	19^0 40'	
	18	18^0 58'	
	20	19^0 14'	20^0 48'
	22	18^0 34'	
	27	19^0 21'	

... Anyhow the above analysis seems to show that the co-ordinates of stars were determined at different epochs. Firstly when γ was respectively 22^0 21' ahead of the present γ, secondly when it was 20^0 8' ahead, and thirdly when it was 19^0 21' ahead. The epochs come out to be 340 AD, 500 AD, and 560 AD, respectively. The first epoch is nearly 200 years from the time of Ptolemy, and if it is assumed that Hindu astronomers assumed Citrā (Spica or α - Virginis) to occupy the first point of Libra, the epoch comes out to be 285 A. D., and the corresponding vernal point 2^0 to the west of Ptolemy's.

This analysis shows that the Indian astronomers had arrived at the idea that the equinoctial point should be properly located with reference to some standard stars and there were probably three attempts, one about 285 AD, the next about 500 AD, and the last one about 570 AD. They had not accepted the first point given by Ptolemy or any western astronomer.

The compiler (or compilers) of the S. S. was clearly unconscious of the precession of equinoxes, and while in his report, he made a selection of these data, he did not perceive that they are inconsistent with the idea of a fixed V.E. point. But he did not err on the fundamental point. He had clearly laid down that Mesādi i.e. the first point of Aries from which the year was to be started was to be identified with the vernal equinoctial point ... "

Quoted above is the complete account of the CRC discovery and definition of the Hindu zodiac achieved after examining all the evidence ranging from Vedāñga Jyotiṣa to Sūryasiddhānta & modern Astronomy. But despite the CRC recommendation and the stamp of GOI the Citrāpakṣa failed to become a unanimous choice amongst the astrological intelligentsia and the wordy warfare remains unabated even today. The Astrological Magazine edited by Dr. B. V. Raman has been all along a medium for the reflection of divergent views in this regard. One of the notable advocates of the Citrāpakṣa there in had been Commodore (retd.) S. K. Chatterjee – an authority of repute in the field of Astronomy and Calendar. Before going into a discussion on the merits of the CRC analysis and conclusions, it is desirable to have a glance over his outline of certain fundamental "Citrapaksha" perceptions in a broader perspective.

• "... as any point can be assumed to be the reference point on a circle, selection of the initial point depends on the practice followed, and there is no mathematical compulsion about it ... "

• The position of the luminaries in the sky is indicated by measuring their co-ordinates along the great circle of either the Celestial Equator or of the Ecliptic and at right angles to them. In the Tropical or Sayana System this reference circle is the Celestial Equator, while in the Sidereal or Nirayana System it is the Ecliptic. For measuring the co-ordinate along the circle, a reference point has to be chosen on it. But in a circle any point can be taken for this purpose and this is where the problem lies. It would be scientific and logical

to choose an initial point on the great circle, which astronomically can be easily defined and located. In the Tropical System, this is done by taking the initial point as the Vernal Equinoctial point, which is one of the intersection points of the Equator and the Ecliptic ...

• In the Sidereal system, the reference point is a fixed point in the ecliptic from which angular measurement is taken ... It will be appropriate to define this point on the ecliptic in relation to a star whose position is fixed in the sky and this star again should logically be a prominent one and close to the Ecliptic.... There has been much controversy in the past about the selection of this initial point but now most of the Pañcāñga makers indicate the longitudes ... with reference to the point in the Ecliptic which is located opposite, that is 180^0 away from the prominent Citrā star (α - Virginis placed close to the ecliptic ... It may be mentioned that the location of this point in the Ecliptic is in keeping with the indication given in the Vedāñga Jyotiṣa that Dhaniṣṭhā nakṣatra division started from the same longitudinal position as that of Dhaniṣṭhā star (α or β Delphini), and also with Varāhamihira's statement that the longitudinal position of Maghā star (α - Leonis) is 126^0.

• However, a few calendaric astronomers though accepting the initial point of the Nirayana Zodiac to be the point opposite Citrā star, have expressed the view that its position on the Ecliptic should be that point whose polar longitude (Dhruvakā) from Citrā is 180^0 mainly for the reason that such type of longitudes for stars have been indicated in Suryasiddhanta. Originally it appears Sūryasiddhāntic(?) astronomers started measuring the position of luminaries in relation to both the Equator and the Ecliptic rather than with reference to only one of these. Dhruvakā or polar longitude of a celestial object was measured by describing a vertical circle to the celestial Equator passing through the object and the celestial pole, and marking the point where this vertical circle cut the Ecliptic, which was not right angles to it but to the Equator. The angular distance of this point along of the date was taken as the Dhruvakā or polar longitude of the celestial object at that instant of time. The vertical angular distance of this object along the vertical circle from the point it cut the Ecliptic was called Vikṣepa or polar latitude. This was a very complicated system of celestial measurement for indicating the position of the luminaries in the sky and this was given up after some time, being inconvenient and a simpler method of measurement for indicating the position of luminaries with reference only to the Ecliptic was adopted, which is continuing to the present day. At present all Pañcāñga makers indicate the position of the Grahas, in ecliptic longitudes and not in polar longitudes. Therefore it will be incongruous to fix the position of the initial point on the basis of polar longitude...

• We all should now sincerely try to bring about uniformity in the basic astronomical data given in our Pañcāñgas ... "

A summary of the analysis of CRC by the above author can be found in Vol. 20, 1985 of the Indian Journal of History of Science.

3. Absurdity of the Recommended Initial Point

The ' Citrā = 180^0 ' recommendation raised a number of questions which neither Prof. M. N. Saha could have answered then (in 1956) nor its present day advocates are capable of answering now (in 1996).

1. Sūryasiddhānta gives the "Polar" longitude of Citrā as 180^0 and the corresponding celestial longitude is 180^0 48'. This is evident from page 265 of the CRC report itself. How can then Citrā be credited with the celestial longitude of 180^0?

We must also note here that the Old - Sūryasiddhānta of Pañcasiddhāntikā has no polar longitudes at all and on the contrary the much older Vasiṣṭha Siddhānta furnishes Citrā's location as *7½ ^{0}* within the respective division i.e. 173^0 20' + $7^0$30' = $180^0$50'. Obviously the value given is celestial longitude because the nakṣatra divisions are not reckoned in terms of polar longitude. Also the seven longitudes of Vasiṣṭha are all different from that of the modern Sūryasiddhānta. Not even an iota of evidence is available to suggest the existence of a tradition going back to AD 285 and the use of vernal equinox as the zero point in AD 285. The CRC story of Sūryasiddhānta astronomers (?) taking three observations in AD 285, AD 500 and AD 570 is nothing but the figments of their imagination.

2. By CRC's own admission – *"The observations made seemed not to be very accurate"* and *"some of the co-ordinates given could not be properly linked with the stars"* – and if it is so, out of the 27 longitudes of Yogatāras, how many of them do correspond to the conception that Citrā is at 180^0?

In fact neither of the longitudes of Sūryasiddhānta are true for the vernal equinox of AD 285 as the zero point! Sūryasiddhānta gives the longitude of Revatī as $359^0$50' and that of Canopus as 90^0 in total contradiction to the concept of Citrā as fiducial. Even if we go by the CRC account that Citrā is at 180^0 – the question remains: What is the sanctity of the point opposite Citrā, when it was discarded by the so-called "Sūryasiddhānta astronomers" themselves? Why not the one they favored in the last viz., Revatī (ζ - Piscium)?

In fact the whole argument of the CRC is deceptive as the tropical longitudes change by about 4^0 in the course of AD 285 to AD 576. Neither of the longitudes is reliable without their date and the possible error in the determination.

3. Further, it is not correct to say that the Siddhāntic texts do not give any indication about the zero point. As shown earlier in the discussion on Siddhāntic astronomy, and as can be seen in the CRC report, the expiry of 3600 Kali years very nearly coincided with the vernal equinox of AD 499. According to Saha's analysis this was one of the epochs at which the polar longitudes were determined and hence there is a remarkable coincidence of the computational theory of the treatise as well as observation at this epoch. The tradition of Āryabhaṭīya also favors the choice of the vernal equinox corresponding to 3600 Kali or $\mathbf{K}_{3623}$ as the initial point.

• *What then is the hitch that prevented the CRC from adopting this epoch?*

• What inspired them to transgress the computational evidence of the treatise – to search for the initial point among a set of longitudes of doubtful origins?

The real anatomy of Sūryasiddhānta as well as the Hindu Zodiac in fact stood beyond the comprehension of the Calendar Reform Committee. From the above discussion the fragile foundations of the Citrāpakṣa school of thought are well evident to any one who is

having an objective look at the problem. Neither is it based on Sūryasiddhānta/ any scientific facts nor is supported by the ancient Indian astronomical tradition. The Calendar reform committee had no respect towards the astrological aspect of the zodiac and the true initial point. Their sole aim was to achieve some sort of uniformity among the regional calendars by forwarding an official solution conforming to the prevalent tradition. CRC had as Secretary, Sri Nirmal Chandra Lahiri – an astrologer who has found the Citrāpakṣa ayanāṃśa to be true astrologically – and under his influence the committee arbitrarily recommended the Citrāpakṣa concept for use in the national calendar. The arguments adduced in the CRC report were all exclusively framed towards this end in retrospect.

4. Notable Observations On Ayanāmśa

In the last hundred years of the ayanāṃśa controversy innumerable propositions and analysis have come out on the subject styled as the most correct solution and in many cases such claims had the support of the dubious horoscopic evidence relying on the adage that the proof of the pudding is in the eating. Still many may hold on to those twisted notions that have no scientific basis or validity in the light of the present work as is evident from the attitude of certain magazines that continue to re-publish the old papers and scholars who are still quoting the CRC report to defend the Citrapakṣa ayanāṃśa.

(a) **Genesis of Citrapakṣa**

Citrapakṣa Rāśicakra today stands credited in the name of Late. Sṛī. Nirmal Chandra Lahiri and the Calendar Reform Committee due to some historical oversight on the part of those who have re-christened it in the name of Lahiri. How meaningless is such an accreditation can be understood from the following facts:

⇒ Among Indian astronomers who have popularized the Citrā's fiducial role, the name of V.B. Ketkar stands foremost. Ketkar himself has not claimed any credit for the concept in his work 'Indian and Foreign Chronology' published in 1921. The following account of his work contains the historical details of the genesis of Citrapakṣa zodiac.

→ The modern astronomers, Mishra Nandrāmji (Śaka 1665), Jyotishroy Kevalarāmji (Śaka 1651) of Jaipur, and Chandra Shekar Sinha of Cuttock, who were also skilful observers have adopted in their works, the Ayanāṃśās determined from the observations of the distance of the star Citra from the autumnal equinox.

→ Great scholars like Mahāmahōpādhyāya Sudhākara Dvivedi of Benares, Srīyuta Lalachandra Śarma of Jaipur and the late A.R.Rājarāja Varma, M.A., Principal, Sanskrit College, Trivandrum, have in their pamphlets strongly supported the course of fixing the first point of Aśvini situated at 180^0 from the bright star Citrā.

→ Sir William Jones, in Vol. IV of his works, says:

"The lunar year of 360 days (tithis) is apparently more ancient than the solar, and began, as we may infer from a verse in the Matsyapurāṇa, with the month of Aśvina, so called

because the moon was at the full, when that name was imposed on the first lunar station of the Hindu Ecliptic, the origin of which, being diametrically opposite to the bright star Citrā (i.e. Spica) may be ascertained on our sphere with exactness".

→ Mr. Davis was a civil servant of the East India Company in AD 1790 at Bhāgalpore. In one of his papers published in the second and third volumes of the "Asiatic Researches", Bengal, he says about the Hindu Ecliptic:

"*Its origin is considered as distant 180^0 in longitude from Spica, a star which seems to have been of great use in regulating their astronomy and to which the Hindu tables of the best authority agree in assigning six signs of longitude, counting from the beginning of Aśvini, their first nakṣatra*".

• As is the case with Calendar Reform Committee in later times Ketkar has also resorted to some false arguments to prove the point that Citrā had a longitude of 180^0 in the Hindu zodiac, the fallacy of which have been already demonstrated. Ketkar too knew the factors that caused the illusion of Citrā's fiducial role as is evident from the following words:

"As regards the starting point the reform will not be a startling one. Because the epoch of the Meṣādi of the Sūryasiddhānta for Śaka year 1844, as calculated by sec.77, falls on April 13.312 and the true longitude of the sun for the same epoch, as calculated from Ketakī (2 cyc. 2200 days), is found to be 359.88. So the distance between the Citrā counter-point and the, moving starting point which was 10 degrees in the beginning of Kaliyuga, is at present reduced to (–) 7 minutes only..."

According to Ketkar himself Citrā counter-point and the moving zero point of Sūryasiddhānta coincided only around Śaka 1844 or AD 1922 [(-) 7 minutes]. As Ketkar had given an annual movement of 8", the year of coincidence would have been precisely AD1870 and this result will nullify all other arguments that Ketkar had adduced in support of Citrāpakṣa.

(b) **Madhura Kṛṣṇamūrthy Śāstry on the vexed question of Ayanāṃśa**

In an article published in the astrological magazine of July 1963 issue (also reproduced in March 2000) Mathura Kṛṣṇamūrthy Śāstry has discussed the vexed question of ayanāṃśa from the siddhāntic point of view. Important points are:

→ Chāyārka – Karaṇārka = Ayanāṃśa, where Chāyārka is the mean sāyana sun determined by observation (dṛksiddha) as per the siddhāntic method and Karaṇārka is the mean nirayana sun computed as per Sūryasiddhānta. The former shall be obviously equal to modern tropical sun when accurately determined.

→ He has given a listing of the zero ayanāṃśa years according to various scholars:

K. M. Raṅgācārya	505 AD
Svāmi Kaṇṇu Pillai	532 AD
M. Vijayarāghavalu	559 AD
Burgess	570 AD
Prof. Whitney	499 AD
Varāhamihira	505 AD
Cidaṃbara Iyer	522 AD
Bhāsvati	528 AD
Gaṇeśa Daivajña	522 AD

In contrast the Calendar Reform Committee had given the year as AD 285 without understanding the implications of Sūryasiddhānta.

→ For 1962 Śāstri has computed the ayanāmśa to be $20^0 8'$ on the assessment that during Varāhamihira's time in Śaka 427 or AD 505 the ayanāmśa was zero. The following words are really noteworthy:

"Rightly, there was no object in Varaha's day for accepting Caitrapakṣa ayanāṃśa. To loose sight of this fact lands one in a maze of unreality. The best way of combating the unreal is to show the real. Even research scholars tend to hug their own pet theories".

(c) **N.C. Lahiri** [In astrological magazine of March 1963 (Reproduced in June 2000)]

A detailed look at Lahiri's views is really rewarding:

(i) Before deliberating upon the value of ayanāṃśa vis-à-vis the Zero-Ayanāṃśa year he has dealt with the necessity of constructing the Sidereal or Nirayana Zodiac when there are so many advantages in the Tropical or Sāyana system of the present-day astronomy.

(ii) According to Lahiri, the Nirayana Zodiac characterized by the "invariability of star positions" is of 'astrological' origin and purpose and is the basis of the specific attributes assigned to the different rāśis and nakṣatras. In the words of Lahiri: "Astrology based on the Nirayana system has, therefore, a rather hard foundation beneath the feet to stand upon".

(iii) On the question of determining the initial point of the Nirayana Zodiac and the value of ayanāṃśa, Lahiri's words are noteworthy:

"The problem is, no doubt, an extremely complicated one, and it does not lead to any unique solution. As a result we are at present getting values of ayanāṃśa varying from 19^0 to 24^0. As the Śāstraic rules dealing with this question are not unequivocal, we shall have to examine each case on its own merits and then arrive at a final decision as to which value should be taken as the correct ayanāṃśa for a year".

(iv) Lahiri then discusses the different computations possible of ayanāṃśa based on the Sūryasiddhānta:

(a) Accepting the theory of trepidation of equinoxes and the precession rate of 54" per year leads to ayanāṃśa of $21^0 56'$ on 1st January 1962.

(b) Adopting AD 499 as the zero ayanāṃśa year and applying the modern precession arc gives for 1962 ayanāṃśa of $20^0 21'$. Under these values Lahiri has added the remarks: "*As it is not possible to fix the year in which the Sūryasiddhānta ayanāṃśa was correct (it may be 499 AD or any earlier or later year), no definite conclusion can be arrived at by proceeding on these lines*". [It is well evident from chapter V of the present work that this opinion of Lahiri is not correct and the zero ayanāṃśa year as per Suryasiddhānta is AD 231 when the vernal equinox coincided with the sidereal zero point and Caitra śukḷa (1)].

(c) Ayanāṃśa is further derived as the difference between the tropical mean sun and the siddhāntic mean sun (nirayana) = $23^0 32'$ for 1962. By this procedure Bhāskara II had determined the ayanāṃśa of 1183 AD to be 11^0.

Bhāskara's ayanāṃśa served the purpose of converting the siddhāntic nirayana sun (whatever might have been the zero reference) to the sāyana sun rather than yielding a correct nirayana value from the tropical one, as Bhāskara had no clear conception of the sidereal zero point. By his time the true sidereal zero point viz., siddhāntic mean sun of Kali 3332 had advanced by roughly $2^0 15'$ east and so his ayanāṃśa was less by the same amount. The true ayanāṃśa was in fact $11^0 + 2^0 15' = 13^0 15'$ for AD 1183 or K_{4284}. Dr. B. V. Rāman did not take into account the eastward advance of siddhāntic initial point in the period since AD 231 and hence the value of Rāman's ayanāṃśa is less by $2^0 15'$.

(d) Ayanāṃśa from a study of the star-positions is attempted subsequently with the following remarks:

"*Burgess had converted the Polar longitudes of the stars into celestial longitudes and the figures are given in his Sūryasiddhānta. Comparing these figures with the actual Tropical longitudes of the relevant stars for 1962, we can find the differences, which are the values of ayanāṃśa for 1962 as derived from the stars in question. But unfortunately no unique solution is arrived at by the process*".

Lahiri outlines the reasons thereof as:

(a) Improper identification of stars
(b) Incorrect reading of the longitudes from the cryptic word numerals in which they are expressed
(c) From the zero-ayanāṃśa years obtained it is evident that all star longitudes were not determined at the same epoch – some were observed before 400 AD, some during AD 450 – 500 or AD 500 – 550 or AD 550 – 600 and some thereafter and they were inserted in Sūryasiddhānta by different observers

(d) As these observers were ignorant of precession some tropical longitudes also got labeled as nirayana
(e) Ayanāṃśa determined from "selected" star positions of Sūryasiddhānta are:

Star	Ayanāṃśa	Zero-year
Aśvini	$21^0 26'$	422 AD
Kṛttikā	$20^0 20'$	501
Rōhiṇī	$21^0 07'$	445
Puṇarvasu	$19^0 50'$	537
Maghā	$20^0 18'$	503
Uttara. P	$20^0 57'$	457
Citrā	$22^0 31'$	344
Jyeṣṭhā	$19^0 08'$	587
P.Āṣāḍhā	$19^0 24'$	568
U.Āṣāḍhā	$21^0 28'$	419
Śrāvaṇa	$18^0 44'$	616
Śatabhiṣak	$21^0 12'$	439
Revatī	$19^0 31'$	560

Lahiri concluded this analysis with the remark that it is rather difficult to assign any definite position to the initial point of the Hindu Zodiac from a study of the star positions of Sūryasiddhānta.

• We must note here that Lahiri wrote these words seven years after the adoption of CRC report and Citrapakṣa Zodiac by the Government of India. How fragile are the foundations of the recommendation "Citrā at 180^0" contained in the report can be understood from Lahiri's own words given above. Even from the selected stars ayanāṃśa values, the highest value was chosen as the ayanāṃśa rather than a mean of these selected star ayanāṃśas. Extraneous considerations did guide such a choice is well evident for otherwise the best course was to adopt the mean value or the most recent of zero-years such as that of Revatī epoch or the value fixed by Bhāskara II with appropriate correction.

(v) Attempt to derive justification from Vedāṅga Jyōtiṣā

Towards the end Lahiri has tried to consecrate the Citrapakṣa Zodiac using false evidence maneuvered in the name of Vedāṅga Jyōtiṣa. To meet his ends the relevant verse is interpreted as – 'winter solstice used to take place...when both the sun and moon became conjoined with the principal star of this asterism (Dhaniṣṭhā)'. Whereas the verse makes no mention of the principal star at all and moreover the principal star is of latitude 30^0 and as such it was impossible for sun and moon to conjoin them. Verse only means that the new moon conjoined solstice at the beginning of the nakṣatra division Dhaniṣṭhā.

Similarly he has dealt with Pañcasiddhāntikā, which according to Lahiri gives the longitudes of Maghā and Citrā respectively as 126^0 and 180^0 – a misreading of the relevant verse facilitates the latter value. By the conventional practice 126^0 in fact means only that the star is in the 126^{th} degree i.e., 125^0 0' to 126^0 0', unless it is a precise statement of longitude as exactly 126^0, which is very rare in Indian classical works. Moreover Lahiri himself has already rejected in the discussion above the siddhāntic star longitudes available in the Sūryasiddhānta as unsuitable to draw any valid conclusions and as such it is surprising as to how could he find the two star positions of Pañcasiddhāntikā as supportive of his arbitrary conclusion.

Can the star positions of Pañcasiddhāntikā be superior to those available in Sūryasiddhānta? If yes, how?

The original argument that he maneuvered can be found in the work of Ketkar also.

(d) **D. V. Ketkar** in May 1963 issue of astrological magazine (reproduced in August 1999)

We can find a novel approach in which he has emphatically answered certain questions relevant to the issue of ayanāṃśa:

→ Can the Siddhāntic sidereal year help us? No!
→ Can the Siddhāntic precession motion help us? No!
→ Can the Siddhāntic zero ayanāṃśa years help us? No!
→ Can the Siddhāntic list of Nakṣatra longitudes and latitudes help us…? No!

He goes on to answer the issue of ayanāṃśa based on Varāhamihira's statement in the Bṛhatsaṃhitā:

Āśḷēṣārdhātdakṣiṇāmuttaramayanaṃ raverdhaniṣṭhādyaṃ I
Nūnaṃ kadācidāsīt yēnōktaṃ pūrvaśāstrēṣu II
Sāṃpratamayanaṃ savituḥ karkaṭakādyaṃ mṛgāditaścanyāt I
Uktā bhāṃśaiḥ vikṛtiḥ pratyakṣaparīkṣaṇaiḥ vyaktiḥ II

Ancient works declare the solstices to have happened at the middle of Āśḷēṣā (Dakṣiṇāyana) and the beginning of Dhaniṣṭhā (Uttarāyana). But now the solstices happen at the beginning of Kaṭaka and Makara as they have regressed (vikṛti) by 27^0, which I have observed to be true.

Ketkar has quoted Nīlkaṇṭha, the famous Kerala astronomer as the authority for the interpretation and derives the ayanāṃśa to be $23^0$20' – $26^0$40' = $03^0$20'. Actually it must be $23^0$20' – 27^0 = (-) $3^0$40' for Varāha's date AD 505 as available in Pañcasiddhāntikā. Ketkar has taken Varāha's date as AD 531 and computes the zero-ayanāṃśa year to be AD 291. He has made also some discussion on Agastya-cihna referred to by Kāḷidāsa and computation of zero year as AD 280 that remains unintelligible to the present author.

On the contrary it must be AD 505 – [3.666*3600/49" = 270] = AD 235 i.e. Varāhamihira was aware of the original epoch of Sūryasiddhānta viz., AD 231.

(e) **V. S. Kaṇṇan** in astrological magazine June 1963 issue [reproduced in November 1999]

Remarkable observations of Kaṇṇan are:

→ In determination of the exact time of coincidence of both the Zodiacs learned astronomers and astrologers have exhausted almost all possible angles.
→ Gives the following tabulation of the Zero ayanāṃśa year:

Cheiro	388 BC
D.Davidson	317 BC
Gerald Massey	255 BC
C.A.Jayne, Jr.	254 BC
Thierens	125 BC
Dane Rudhyar	97 BC
Paul Councel	0 AD
Cyril Fagan	213 AD
Lahiri	285 AD
P.C.Ray	319 AD
M.K.Kharegat	345 AD
B.V.Raman	397 AD
Sepharial	498 AD

→ Citrā's longitude as per Greek records is given which are:

Astronomer	Date	Citrā's tropical λ	True ayanāṃśa	Sidereal λ
Timocharis	BC 293	$22^0 20'$	$7^0 16'$	$29^0 36'$
Hipparchus	BC145	$24^0 20'$	$5^0 13'$	$29^0 33'$
Menelaus	AD 99	$26^0 15'$	$1^0 50'$	$28^0 05'$

[It is apparent from this data that Citrā was not at all considered as fiducial in ancient times and in fact it represented the Kanyā rāśi being the most prominent of the stars in that constellation]

→ He has given the following quote from Sepharial: "By reference to various Sanskrit and vernacular works, we have decided, in common with many competent Pandits, that the two Zodiacs exactly coincided in the year of the Kaliyuga 3600. And this agrees with the observation of Mihira in his Saṃhitā...."

Notwithstanding all such quotations he has given, ultimately he has voted for Citrapakṣa.

[Proponents of the various theories have all quoted Varāhamihira to prove their point – *ēkaṃ sat viprāḥ hbahudhā vadanti*!]

(f) **Dr. W. J. Tucker**, A.M., November 1962 [reproduced in August 1998]

Notable observations are:

→ No Zodiac ever existed prior to a point in time round about 400 BC.
→ The first Zodiac of which we have actual record is a Babylonian record of 13 asterisms beginning with Ni-sannu of approximately 400 BC.
→ The first Babylonian solar Zodiac had its beginning with the Aldebaran rising over the mountain Taurus conjoined with new moon and it was at a later stage KU or Aries was adopted as the leading sign.

→ "*The one and only reason why the Zodiac was not invented before 400 BC was because the astronomical data upon which the lunar and solar zodiacs could possibly be based had not yet been discovered. Not until Hipparchus had discovered the precession of equinoxes in the second century BC was it possible to invent a solar Zodiac, simply because the Zodiac is a belt forming a circle in the sky; and a circle has neither beginning nor end. Consequently it was the phenomenon of the sun crossing the celestial equator at the equinox, which gave mankind the idea of using that point of intersection as the starting point of the ecliptic circle. Yet the importance of that point did not strike the imagination of men before Hipparchus discovered precession....*"
→ Dr. Tucker has quoted Dr. B. V. Raman:

"*The exact period when both the Zodiacs coincided in the first point is not definitely known and accordingly, the Ayanāṃśa – the precessional distance – varies from 19° to 23°. The star which marked the first point seems somehow to have disappeared though some believe that it is 11' east of the star Pisces*".

[Emphasis added by me in the last but one quote must be noted. Tucker, who is regarded as a great western scholar and astrologer, is unable to imagine the existence of a zodiac before 400 BC and a zero point for the circle before the time of Hipparchus]

(g) **Paper of XVI** of the series by Y. Pradhan, K.V. Bhat and H.B. Karapatel

Authors have criticized the Calendar Reform Committee in no mistakable terms:

→ "The Committee appointed by the Government of India has not discussed the Ayanāmśa question properly. They simply took 21st March 1956, the first day of the Śaka Year 1878 (the middle of the five-year period) 1876 – 1880), as a standard year and assigned thereto 23°15' as the value of the Ayanāmśa for Nakṣatras. This random shot was fired probably because this value was desired by Mr. N.C. Lahiri for 1956. But this value has no scientific basis whatsoever...this value was only a makeshift. The Chairman (Dr. M. N. Saha) himself frankly admitted this when he observed: "This recommendation is to be regarded only as a measure of compromise so that we avoid a violent break with the established custom". It is a pity a section of pundits has imparted a good deal of

glamour to this makeshift ayanāmśa, more by artful propaganda than sound reasoning; as a result of this the gullible public have been led to believe that at long last, these pundits had discovered exactly the initial point of the Hindu Zodiac once known only to the ancient Ṛṣis".

About the Citrapakṣa Zodiac:

→ In Śaka 1826 (1906 AD), the Conference of All India Astrologers and Astronomers held in Bombay stated that the value of Ayanāṃśa derived from Maghā and Citrā as given in the Siddhāntas would prove illusory. If we assent that we can derive the correct value of the ayanāmśa from the longitude of the one star why should not other values *derived from other stars be also deemed to be correct*? (Emphasis added by present author).

→ The late Mr. V. B. Ketkar asserted on the advice of Mr. Dikshit that if we adopt a value of ayanāṃśa, which is close enough to values obtained from the Siddhānta, it will be acceptable to the public. But it is well known that the values of longitudes of the stars given in the Siddhāntas are incorrect. But by taking the value of ayanāṃśa from μ-Piscium or taking the starting point opposite the star Spica, the suspicion of the people will not be aroused and by computing Pañcāṅgas on this basis, they will come into general use by the people. Mr. Ketkar took the starting point opposite Spica and compiled his Jyōtirgaṇita in Sanskrit on that basis. However, the 1826 conference decided that since we cannot get a correct value of the ayanāṃsa from the longitudes of Citrā or Maghā, the value as given by Mr. Ketkar in his book was incorrect. Hence his value was not generally accepted and did not come into general use. Mr. Ketkar carried on a lot of propaganda in favor of his value of the ayanāṃśa with the starting point opposite Citrā. The values deducted from Suryasiddhānta, Grahalāghava and Citrapakṣa are very nearly equal and Mr. Ketkar's calculations agreed with the values so derived. Several Pundits blindly accepted the Citrapakṣa value without any further critical examination. Mr. Lahiri also accepted this value on Ipso Dixit of Mr. Ketkar, but he affected a slight modification there-in by taking into account the proper motion of Spica and reducing the then published value of the ayanāṃśa by 1'2". About 75 almanac compilers also accepted the revised value under the impression that as it was accepted by the Government it must have been correct. These compilers never gave a thought to the resolution passed by the previous 1826 Conference that this value was absolutely incorrect.

→ Why did Mr. Lahiri take the celestial longitude of Citrā as only 180^0 when the Sūryasiddhānta gives this a value of $180^0 48'48''$[1] for this longitude? The difference of 49' will make a difference of about 49 ghatis in the time of a solar ingress and a difference of several days in the time of the sun and the planets in Rāśis and Nakṣatras. (sic)

Further, the authors have thrown light on false arguments used by Lahiri to justify his choice of ayanāṃśa. Different Siddhāntas give different values of λ for Citrā and so if Citrā is taken as fiducial a number of ayanāṃśas will result – one each for Ādi

[1] Sūryasiddhānta does not give the value of $180^0 49'$ (celestial longitude). It gives the polar longitude as 180^0, which by proper conversion yields $180^0 49'$ as celestial longitude.

Sūryasiddhānta, Sūryasiddhānta, Brahmasphuṭasiddhānta, Dvitīya Āryasiddhānta etc. In their words:

"If we only take the 27 stars given by the Sūryasiddhānta and calculate the starting point (i.e. 0^0) from each of these stars, we will get 27 different values (positions) of the starting point. But there is a difference of opinion as to which Yōgatāra is to be assigned to which nakṣatra and if we take all the possible stars into consideration, we will get 25+27 = 52 different results. If we take other Siddhāntas also and work in the same manner we will be lost in the labyrinth of 175 different values of the starting point. Will Mr. N. C. Lahiri condescend to take note of this and give the scientific reasons for the particular value selected by him for his ayanāṃśa out of the present-day Babel of ayanāṃśas? We also put this question to Messrs Firebrace and Cyril Fagan. We also ask all those astrologers who are clamoring for nakṣatras, the Nirayana system and so on purporting to trace their initial point back to the dawn of creation. How will their values give predictions in astrology when there are all these differences and uncertain values of the ayanāṃśa used by them? We repeat that according to our belief Nirayana Saṃkrāntis have no religious sanction".

Authors in their conclusion have pleaded for Sāyana system – even for Nakṣatras beginning with Aśvini – as it is the only system that is true to the only tradition set up by the Vedic Ṛṣis. Nirayana system is decried as merely the product of some benighted post-Vedic Era. In the event of an inability to discard the Nirayana tradition they have recommended β-Delphini as fiducial at $293^0$20' as the resulting Zodiac accommodates 24 of the 27 Yogatāras in their respective equal divisions.

Against the above background of the various attempts to resolve the riddle of ayanāṃśa present author would like to frame the issue in an altogether different manner to strike out the true scientific solution for the controversy of ayanāṃśa.

Mathematically (or geometrically) every point of a circle is on par with the other to be considered as the zero point. As such the approach of the CRC was that the choice if the initial point of the zodiac was a matter of calendaric origin and no physical rationale could be thought of as the basis of the zodiac. The ancient authorities were of no help in this regard and it was this predicament that forced Late Sri C. G. Rajan to admit defeat in his effort to determine the correct ayanāṃśa:

"I wish to impress once more on the reader that for the reasons set forth in section VI (2), it is not possible, with the information available at present to determine the exact quantity of ayanamsa. This is my humble opinion born of my attempts of over a decade to determine the correct ayanamsa…. "

The present attempt to decipher the "True Sidereal Zodiac" and "True Ayanāṃśa" is to be viewed and understood against the above predicament.



V

TRUE SIDEREAL ZODIAC

"In the light of finally obtained knowledge, the deductions seem almost self-evident and can be understood, with no great difficulty by any intelligent student. But the foreboding search in the dark, with its intense yearnings, its alternation from confidence to despondence and then the ultimate break-through to final clarity, can only be perceived by some one who has experienced it himself"

Albert Einstein (1934)

"... if you want truth that will not change with tomorrow's observations you do not look for it in science. You look for it in mathematics"

"A proof is a construction that can be looked over, reviewed, verified by a rational agent. We often say that a proof must be perspicuous or capable of being checked by hand. It is an exhibition, a derivation of the conclusion, and it needs nothing outside itself to be convincing. The mathematician surveys the proof in its entirety and thereby comes to know the conclusion"

"Man has been disciplined hitherto by his subjection to nature. Having emancipated himself from this subjection, he is showing something of the defects of slave-turned-master. A new moral outlook is called for in which submission to the powers of nature is replaced by respect for what is best in man. It is where this respect is lacking that scientific technique is dangerous. So long as it is present, science, having delivered man from bondage to nature, can proceed to deliver him from bondage to the slavish part of himself"

Bertrand Russell (The Scientific Outlook, pp. 278 -279)

"A very small cause which escapes our notice determines a considerable effect that we cannot fail to see, and then we say that the effect is due to chance. If we knew exactly the laws of nature and the situation of the universe at the initial moment, we could predict exactly the situation of that same universe at a succeeding moment. But even if it were the case that the natural laws had no longer any secret for us, we could still only know the initial situation approximately. If that enabled us to predict the succeeding situation with the same approximation, that is all we require, and we should say that the phenomenon had been predicted, that it is governed by laws. But it is not always so; it may happen that small differences in the initial conditions produce very great ones in the final phenomena. A small error in the former will produce an enormous error in the latter. Predictions become impossible, and we have the fortuitous phenomenon"

Poincare, 1903

IV

TRUE SIDEREAL ZODIAC

1. An Intuitive Solution

The work under publication – the quest for the true sidereal zodiac described - here in had it's beginning in 1994 inspired by the failure of an astrological assessment. With the best of reasoning no fault could be invented to decry the logic employed and hence the said error in astrological analysis could be credited only to the Zodiac employed. In consequence the quest began for the true zodiac in the labyrinths of ayanāṃśas with little knowledge of astronomy, history and the Indian astronomical tradition. As I could paraphrase in later times the few cardinal questions that I stumbled upon were:

- Had the fixed stars been the criterion in deciding the stellar limits the easiest solution was to define the zero point from a bright star like 'Citra' or 'Rohiṇī' (Aldebaran: α - Tauri) or an ecliptic star like the Regulus.

- As pointed out by certain scholars had there been 'no mathematical compulsion' as regards the choice of zero on a circle, then also the most convenient solution was to make the zero over a bright star. But we have no record of such special significance ascribed to any bright star – why?

- A point in between two stars could have achieved significance only by virtue of phenomenal reasons such as the fall of equinoxes and solstices or other astronomical occurrences.

- Every point on the Zodiacal circle is on a par with the other mathematically or geometrically to become the zero point. Similarly any of the 27 Yogatārās may be considered as the zero point as per observational convenience. Further, as is evident from the innumerable regional calendars either of the equinoxes or solstices or any other point can be assumed as the zero to define a Zodiac and point of time or epoch.

- What is 'special' about the Yogatārā of Citra, Revatī or Rohinī or what is the sanctity of the longitudes referred to either of these stars to be indicative of destiny?

- Time is eternal, has neither a beginning nor an end. Jyotihsastra describe it as Kalacakra to emphasize the cyclic nature. Every perceivable moment is preceded by innumerable cycles, an infinity of time, and wherever infinity is involved no computation is possible. All astronomical computations in time therefore require a hypothetical beginning

an epoch with reference to which the successive moments can be flagged in terms of astronomical phenomena.

Providence offered immense guidance and it became apparent that the clue towards solving the riddle of ayanāṃśa was in the beginning of Kaliyuga, the Hindu astronomical beginning of time. A possible solution was to fix the ayanāṃśa of Yugādi and to apply the modern astronomical rate of precession to find out the zero ayanāṃśa year and the subsequent arc of precession. The astro-mythological birth of Brahmā - the progenitor of Siddhāntic astronomy who presided over the cycle of Yugas - in the Rohiṇī nakṣatra was interpreted as a cryptic statement of the position of the vernal equinox at Kaliyugādi in the middle of the Rohiṇī nakṣatra division, i.e. at $46^0 40'$. The average rate of precession in the ensuing period was then derived using a most irrational interpretation of the Ṛgvedic verse III.9.9, which depict the astronomical magic number 3339: On assuming 3339 years for the ayanāṃśa to become zero the emerging ayanāṃśa values appeared to be satisfactory on horoscopic analysis. The astrological problem, which inspired the quest for the true zodiac could be resolved without condemning the logic employed in the assessment and therefore a monograph entitled "True Ayanāṃśa" was published in 1994 October. In 1994 the respective ayanāṃśa was $24^0 32'$ and this value in turn suggested that the star Mūla or Lambda Scorpii is the fiducial star of the Hindu sidereal fixed zodiac.

As a physicist it was doubtlessly clear to me that if the above conjecture and the astrological verification of the ayanāṃśa values contained an element of truth, Mūla's fiducial role must receive further confirmation from the Indian astronomical tradition as well as the earliest known treatise of Indian astronomy, namely, Sūryasiddhānta.

2. Sūryasiddhānta and Sidereal Zodiac

As is well known the epoch of the extant version of Sūryasiddhānta which employs the solar year of 365.25875 days is Śaka 421(elapsed) or $\mathbf{K}_{3600}$. Since the time of Hipparchus and Ptolemy vernal equinox had been the zero point and the concept of a stellar fixed zodiac had fallen into oblivion not only in the Middle East but also in India as can be gleaned from the old Siddhāntas traceable in the Pañcasiddhāntikā compiled by Varāhamihira. Original conceptions underlying the sidereal zodiac must have therefore undergone modifications by AD 500, where in we see the emergence of a new paradigm of astronomy having vernal equinox as the zero point. In view of the use of synodic observations as well as the assumption of a synodic super-conjunction in the computational frame, a shift in the zero point meant a modification of the solar year. With due attention to these facts the sidereal zodiac implicit in the Sūryasiddhānta can be deciphered in two ways by analyzing the computational frame of Sūryasiddhānta.

1. We saw earlier that the solar year of Sūryasiddhānta is extra-long as compared to the sidereal year and hence in the real sense the Siddhāntic computations could never have been sidereal in the absence of appropriate provisions to account for this surplus.

The Solar year of Sūryasiddhānta = 365.258756 days (Y)

Modern sidereal year (AD. 500) = 365.256450 days (Y^s)
Modern tropical year = 365.24219 days (Y^t)

The surplus of 3.3 minutes in the Siddhāntic year makes the computation nearly anomalistic rather than sidereal, and the surplus accumulates to about 8.3 days in computation over 3600 years. As such in Siddhāntic astronomy we have got an "anomalous" Zodiac due to some unknown historical reasons. Obviously the fixed initial point must have undergone modification in the above anomalous situation. Further we have no idea as to the physical rationale with which the Zodiac must have been initially conceived and hence no way to ascertain the veracity of either the Siddhāntic zodiac or the Citrapakṣa zodiac. According to a well-known scholar: *" as any point can be assumed to be the reference point on a circle, selection of the initial point depends on the practice followed, and there is no mathematical compulsion about it..."* i.e. the initial point of the zodiac is a matter of arbitrary choice – if so also we have no way to adjudge a particular choice as true. But in reality the situation is different – whether arbitrary or not the Sūryasiddhānta can have only one fixed zodiac implicit in it and the same can be deciphered by analyzing the relationship of its solar year with the configuration of the vernal equinox and the mean Sun.

The mean-Equinox since the beginning of Kaliyuga, as per Sūryasiddhānta can be expressed as:

- Ahargaṇa (N^{th} equinox) = $N.\ Y + 60 - N\ (Y\text{-}Y^t) = 60 + NY^t \rightarrow$ (**A**), Where Y^t is the modern tropical year = 365.242371 days (500AD)

- Mean tropical-Sun (N^{th} Kali year) = $360^0 - 60^0 + N\ (Y\text{-}Y^t)$
  $= 300^0 + N\ (Y\text{-}Y^t) \qquad \rightarrow$ (**B**)

Both these equations can be shown to be true by computation. At the expiry of 3623 Kali years (1323332.5days), N (Y-Yt) = 60 days and hence the mean Sun of Kali year 3623 (elapsed) coincided with the vernal equinox of $\mathbf{K}_{3623}$ or AD522.

- **Mean Sidereal Sun**

To understand the relation that governs the sidereal mean longitude of Sūryasiddhānta, we must know the ayanāṃśa of the great epoch of Hindu astronomy viz., the beginning of Kaliyuga - midnight of 17/18 February 3102 BC. If we extrapolate back the different conceptions prevailing on ayanāṃśa to 3102 BC, it can be found that the vernal equinox will be falling on either side of the Rohiṇī mid-point ($46^040'$). For example: N.C. Lahiri, Secretary of the Calendar Reform Committee gives the ayanamsa of 3102 BC as $46^0\ 35'$ while B.V.Raman's value turns out to be nearly 48^0. The correct value may be deciphered on the basis of the following grounds.

Divisions of the Ecliptic into Rāśis & Nakṣatras

Calendar Reform Committee has frankly admitted their ignorance on this vital aspect of Hindu zodiac. A division of the ecliptic into 30^0 each and $13^020'$ each means a division of 360^0 into 108 parts of $03^020'$ each i.e. the 108 navāṃśas or the nakṣatra-pādas.

$$360^0 = 30 \times 12 = 13^0\ 20' \times 27 = 03^0\ 20' \times 108$$

This fundamental mathematical division finds its reflection in the 108 names of Sun enumerated in the Mahābhārata, Brahmāṇḍapurāṇa etc. The obvious first step in such a geometrical division will be the division of 360^0 into four quadrants of 90^0 each. At any point of time, equinoxes and solstices are the most convenient references for a division of the ecliptic into four quadrangles. Ṛgveda (1.155.6) perhaps refers to such a division of the ecliptic by the equinoxes and solstices. Another scriptural evidence is:

Maitrāyaṇa Upaniṣad VI.14

"The visibility of time is its increase from the twinkling of an eye to the year of twelve parts. Of this year, one-half is consecrated to Agni and the other to Varuṇā. The movement from Maghā up to half of Śraviṣṭhā is consecrated to Agni and the northward movement from half of Śraviṣṭhā upto Sarpah is consecrated to Soma. Every month of the year consists of nine quarters (fourth parts of the 27 nakṣatras) in conformity with the associated nakṣatra ... "

The epoch referred to herein correspond to the fall of solstices along 120^0 - 300^0 and equinoxes at 30^0 - 210^0 in the remote antiquity of 1900 BC. This description of the sidereal zodiac of 108 divisions with the equinoxes and solstices at the junction points of the quarters or navāṃśas explodes the common notion that the Yogatārās were the reference for the creation of the nakṣatra divisions. 108 points were involved in the division instead of 27 and the equinoxes and solstices of the reference point of time were among these points. In fact, here we have a real illustration of the definition of an epoch as per the canons of pre-Siddhāantic, Vedic astronomy. It is quite likely that the great epoch of Kaliyugādi may be the relic of such a pre-historic epoch of the Vedic astronomy.

On the above basis the epochal configurations of the equinoxes and solstices can be identified as $46^040'$ (Vernal equinox), $226^040'$ (Autumnal equinox), $136^040'$ (Summer solstice) and $316^040'$ (Winter solstice). Further with the etymological reasoning of the terms Mūla: (root or fixed) and Jyeṣṭha: (eldest or first) in contrast to the autumnal equinox at $226^040'$ the Yogatārā of Mūla (Lambda Scorpii) can be identified as the fiducial star located at 240^0 of the sidereal zodiac. Taking the ayanāṃśa of $\mathbf{K_0}$ to be $46^040'$ for the sidereal zodiac implicit in Sūryasiddhānta:

Sidereal Mean Sun $= 346^040'\,[Y^t/360] + N\,(Y-Y^t)$ ($[Y^t/360]$ converts $46^040'$ into days)
$= 347^d\,21^{gh} + N\,(Y-Y^s)$ $\rightarrow$ **(C)**

Siddhāntic Zero Point

The most fundamental assumption of Siddhāntic astronomy is that all the sidereal mean longitudes were at the zero point for the beginning of Kaliyuga. As per the model described above Aśvinyādi or the zero point was 60 days East of the tropical mean Sun of Yugādi and $46^040'$ west of the vernal equinox. Also, the Siddhāntic tradition took the aphelion/perihelion to be stationery and obviously the Sun that supposedly marked the fixed zero point was bound to have a constant mean anomaly since $\mathbf{K_0}$.

Zero Ayanāṃśa Year

Coincidence of the sidereal and tropical zodiac required (B) and (C) to be equal and the Ahargaṇa of the date must correspond to the mean equinox. On equating (B) & (C) we get,

$$300 + N\,(Y\text{-}Y^{t}) = 347^{d}\,21^{gh} + N\,(Y\text{-}Y^{s}) \qquad \rightarrow \textbf{(D)}$$

i.e. $N = 47^{d}\,21^{gh}/(Y^{s} - Y^{t}) = 3339$; the sidereal and tropical longitudes of sun coincided at the expiry of Kalí 3339. But the Ahargaṇa of 3339 Kalí (elapsed) = 1219599 days do not correspond to the mean equinox, as 3339 $(Y\text{-}Y^{t}) = 55^{d}\,17^{gh}$ only from Aśvinyādi. That is, the sun reaches the zero point after $60^{d} - 55^{d}\,17^{gh}$ = 4 days and 43 ghatis, corresponding to the ahargaṇa of 1219599 + $4^{d}\,43^{gh}$ = 1219603.684 approximately. This in fact is the Ahargaṇa for the mean equinox of AD 238 (23rd March, Friday) that marked the coincidence of sidereal & tropical zodiacs.

It must be noted here that the solar year of Sūryasiddhānta (Y=365.25875 days) was insufficient to make the expiry of Kali 3339 coincide with the mean equinox. The reason for this discrepancy is that the extant version of Sūryasiddhānta represents the epoch of Āryabhaṭa viz., $\mathbf{K}_{3600}$ or $\mathbf{K}_{3623}$ (elapsed).

Equinox of $\mathbf{K}_{3623}$

The expiry of Kali year 3623 (Ahargaṇa = 365.25875 × 3623 = 1323332.451) coincided with the respective mean equinox of AD 522 and as such this epoch could have represented the coincidence of sidereal and tropical zodiacs. According to popular belief it was Kali 3600 rather than Kali 3623 that represented the epoch of Āryabhaṭa and led to the genesis of the solar year of 365.25875 days. But the Kerala tradition as well as modern astronomical computation justifies the choice of Kali 3623. Calendar Reform Committee chose to ignore the 18' decrement in the longitude of Sun and accepted K_{3600} as the epoch of Sūryasiddhānta. The vernal equinox of $\mathbf{K}_{3600}$ stood at 1^{0} east of Revatī (Zeta Piscium) and was one of the three initial points deciphered by the CRC. As mentioned earlier the CRC could not provide any explanation for rejecting the above zero point which had the sanction of the Siddhāntic tradition. But the interpretation model described above explicitly brings out the fallacy of this epoch.

Mathematically, equation (D) i.e. the equality of sidereal and tropical mean longitudes does not remain valid for $\mathbf{K}_{3600}$ or $\mathbf{K}_{3623}$. Obviously for $\mathbf{K}_{0}$ Vernal equinox was at $46^{0}40'$, which makes the sidereal mean Sun for $\mathbf{K}_{3623}$ equal to 356^{0} in view of the 4^{0} precession between $\mathbf{K}_{3339}$ and $\mathbf{K}_{3623}$. Precession during - the course of $\mathbf{K}_{0}$ - $\mathbf{K}_{3623}$ amounts to $50^{0}38'$ rather than 46^{0} 40'. As explained earlier the division of the ecliptic into 108 nakṣatra pādas using the Yugādi equinoxes & solstices as well as the fiducial star Mūla demands the ayanāṃśa of $\mathbf{K}_{0}$ to be $46^{0}40'$ i.e. the vernal equinox at Rohiṇī midpoint. The mythological story of Brahmā, the creator as taking birth in Rohiṇī nakṣatra probably arose out of the ancient astronomical conception of Yugādi with vernal equinox at Rohiṇī midpoint.

Equinoxes of AD 576 and AD 285 – Initial points of CRC

It is apparent from equation (**B**) that the mean tropical sun coincided with vernal equinox of $\mathbf{K}_{3623}$ for the solar year-length of 365.25875 days. As a result of the continued use of this extra-long sidereal year the zero point had a progressive movement towards east by 0.00239 days per year. As Revatī (Zeta Piscium) was on the west of the vernal equinox of $\mathbf{K}_{3623}$, the fall of equinox on Revatī in AD 576 was of no consequence to the zero point of Sūryasiddhānta. Had the equinox on Revatī been of any relevance to Sūryasiddhānta, the year length would have definitely undergone a reduction as can be seen in the Brahmasphuṭasiddhānta of Brahmagupta. In fact, with the solar year of 365.25875 days the mean Sun corresponding to the expiry of the Kali year would have coincided with Revatī only for $\mathbf{K}_{3339}$. Polar longitude of Revatī as $359^0 50'$ available in the extant version of Sūryasiddhānta is not compatible with the mathematical implications of the solar year of 365.25875 days.

Similar argument holds good for the vernal equinox of AD 285 that fell on the point opposite Citrā. The solar year of 365.25875 days could never have taken the mean sun for the expiry of Kali 3386 to coincide with the respective equinox falling opposite Citrā.

In view of the above reasons the so-called Revatīpakṣa and Citrapakṣa schools of ayanāṃśa have no locus standii in the context of Sūryasiddhānta or the ancient astronomical tradition of India. The almost zero longitude of Revatī got incorporated in the Siddhāntic tradition only after the advent of Brahmagupta in the 7^{th} century AD. As regards Citrapakṣa, the eastward progress of the Siddhāntic zero point touched the point opposite Citrā or vernal equinox of 285AD only towards the end of the 19^{th} century i.e., near about AD1885. The Siddhāntic Pañcāṅgas (ephemeris) of this period (for e.g. Vākya-pañcāṅga that prevailed over South India) therefore had their zero point falling opposite Citrā by accident and consequently the modern astronomical tropical longitude of sun and the corresponding Siddhāntic sidereal value had the difference equal to an ayanāṃśa based on Citra's opposite point. At the end of the 19^{th} century and in the beginning of 20th century efforts were made in the South, Maharashtra, Bengal etc. to switch over from the Siddhāntic computations to more accurate modern astronomical system. Due to the above reason, the most convenient solution was to define an ayanāṃśa that will serve the Siddhāntic zero point of AD 1880 (end of 19^{th} century) so that the prevailing tradition is not disturbed very much.

3. Evidence of the Constant Mean Anomaly

Siddhāntic tradition had the aphelion/perihelion fixed while the sun marked the fixed zero point at Yugādi ($\mathbf{K}_0$). With the fixed aphelion, if the sun was to mark the sidereal fixed zero point at the expiry of subsequent Kali-years, the solar year had to be anomalistic. In other words, if Sun marked the fixed zero point at $\mathbf{K}_0$, this fixed point must be of a constant mean anomaly (as the aphelion remained stationery) and the vernal equinox would have coincided with this zero point on attaining the mean anomaly Sun had at $\mathbf{K}_0$. On this basis the zero point of the sidereal zodiac implicit in Sūryasidhhānta can be deciphered on the following lines:

Important Theoretical Considerations

- According to Sūryasiddhānta a synodic super conjunction and sun marked the zero point at the beginning of Kaliyuga on UT-3101 February 17, 18:30:00 (JD=588435.2708).

- Sun corresponding to the expiry of the respective Kali year, has remained the zero point ever since $\mathbf{K_0}$ and the planetary mean longitudes as per Sūryasiddhānta were all simply elongations with reference to the sun.

- Solar aphelion/perihelion had been almost stationery (7'12"only in 3600 years) and obviously the zero point had a constant mean anomaly since $\mathbf{K_0}$.

- Mean anomaly at $\mathbf{K_0}$ as per modern astronomical computation is $105^0 16'$ for the sun that marked the fixed zero point.

- According to modern astronomical computations the spring equinox had a mean anomaly of $105^0 16'$ in AD 238 and the respective Kalidinaṃ contained precisely 3339 anomalistic years.

Original Epoch of Indian Siddhāntic Astronomy

Even though the treatises like Āryabhaṭīya (Kālakriyāpāda-verse 11)[φ] declares Caitra-śukḷa-pratipada as the beginning of the year and the greater divisions of time such as Yuga, Kalpa etc., neither of the Siddhāntic epochs, say of Sūryasiddhānta or Āryabhaṭīya satisfied this stipulation. It must be remembered here that even Vedāṅga-jyotiṣa had a computational epoch beginning from Śukḷa-pratipada that coincided with the winter solstice. Obviously when the year beginning had a shift to the Vernal equinox it must have taken place at a coincidence of the Vernal equinox with the Caitra-śukḷa-pratipada. In the absence of such a tradition there was no reason for the Siddhāntic astronomers to ascribe a beginning for the Year and Yugādi with the Caitra-śukḷa-pratipada. It is apparent that the intricacy may be because of the redactions undergone by the Siddhāntic treatises around AD 500 in which the original epoch of Siddhāntic astronomy might have got obliterated.

On examining the luni-solar configuration of the vernal equinoxes around AD 233, the following astronomical data strikes our attention. The vernal equinox of AD 231 precisely satisfied all the aforementioned astronomical factors that would have truly characterized the original siddhāntic epoch and year beginning with Caitra Śukḷa-pratipada.

Epoch: 21 march 231AD, Monday 15 30 UT (2033 Ujjain LMT), Vernal Equinox coincided with Caitra Śukḷa-pratipada. JD [TDT]: 1805510.22908. Mūla (λ-Scorpii) precisely had a longitude of $239^0 58' = 240^0$ from the vernal equinox.

[φ] Yugavarṣamāsadivasāḥ samaṃpravarttāstu caitraśukḷādeḥ

New moon took place on Monday at 1035UT or 1538 Ujjaini LMT for JD [TDT] =1805510.0238655. Tuesday coinciding with the Śukḷa-1 marked the beginning of Caitra at Ujjain. The epochs $\mathbf{K_0}$ and $\mathbf{K_{3332}}$ corresponded to JD [TDT] of 588466.34939 and 1805510.372718 respectively. In terms of UT the epochs were separated by 1217045 days =1217045 days = 3332 X 365.2596038 i.e. 3332 anomalistic years.

Mūla's fiducial role

Mūla has a fixed longitude of 240^0 over the sidereal zodiac. As can be seen in Indian Astronomical Ephemeris the proper motion of Mūla can be taken as zero and accordingly Mūla had it's sidereal and tropical longitude equal to 240^0 at the vernal equinox of AD 233 (UT: 21 March 233, 03:23; JD[TDT] = 1806240.72368). Ayanāṃśa as such may be computed either from the vernal equinox of AD 233 or by subtracting 240^0 from the modern tropical longitude of λ-Scorpii. On 2nd July 2000 the tropical longitude of λ-Scorpii is $264^0$35'33.76" and hence the ayanamsa will be $24^0$35'33.76". Alternatively, if we take the vernal equinox of AD231 coincident with Caitra-śukḷa-pratipada as marking the zero point the ayanāṃśa will be $24^0$37'.

4. Physical Rationale of the Initial Point

In the realm of physical sciences every mathematical result must have a physical interpretation that explains its relation with the phenomenal Universe. Similarly, if we consider Jyotiḥśāstra the mathematically deciphered initial point, whatsoever it may be, must lead to a physical or occult rationale that justifies its use for astrological purposes. Dr. M. N. Saha's initial point opposite Citra or α-Virginis fails miserably in this regard. The Committee headed by Dr. M. N. Saha approached astrology and the Hindu fixed zodiac as a calendaric Custom rather than as a science and was bothered only about standardization. As such they failed to think of a physical interpretation for their "Standard initial point" so that the same is established as 'true' in the context of astrological application.

As we saw in the preceding part innumerable zodiacs are under prevalence in different parts of the world – tropical and the multitude of sidereal zodiacs – all claiming supra-scientific validity. Even the tropical versus sidereal conflict involving a difference of more than 20 degrees remains unresolved due to the unscientific attitudes in the practice of astrology. Nothing can be more absurd than the coexistence of the sidereal and tropical zodiacs and differing horoscopes to represent the unique personality and character of a nativity even though both the schools preach and teach the same sign lordships, house significations etc. The real fact is that the arguments in favor of the different propositions are all fragile and the political or sectarian subjectivity is ruling the roost instead of the subjectivity of the occult discipline in the horoscopic substantiation claimed by the different groups.

• How can the horoscopes differing in longitudes by as much as 1^0 to 25^0 truly reflect the unique personality, character and destiny of the same human being? Can we find a circle illustrative of two different values for π?

• What prevents us from identifying the true zodiac? In other words what is the identity of the true zodiac?

The different schools of thought on ayanamsa fail to provide a convincing definition of the zodiac and invariably all of them limit the antiquity of Hindu astronomy and astrology to their respective zero ayanāmśa years in 3rd to 6th Century A. D.

• If this is so, how could Lord Rudra expound this divine science to Sri Parvati? How can astrology be a divine science emanated from the conscience of our Great Sages? How can we describe astrology as 'Vedic' wisdom?

As mentioned earlier the fixed stars, Yogatārās, were not the criterion in the division of the ecliptic into 27 equal divisions called nakṣatras vis-a-vis the 108 nakṣatra pādas (quarters). The 27 Yogatārās were neither at equal intervals nor they could be in their respective division as per any common criterion. Further the 27 junction stars were quite insufficient for a division of the ecliptic into 108 equal parts. Obviously, it will be wiser to consider the division of the ecliptic into 108 parts as purely mathematical and the choice of initial point as based on some physical rationale.

Principle of Symbolic Equivalence of the Microcosm and Macrocosm

The basic postulate of Jyotiḥśāstra is the *Symbolic Equivalence of Man and Zodiac* and therefore an initial point becomes the true zero point only if it makes the resulting zodiac (Kālapuruṣa) an exact replica of the human being (Jīvapuruṣa). This demands an astronomically defined physical point over the human body. Tantra, another ancient Hindu discipline has fortunately preserved this information and the point of *Bio-Celestial Symbolic Coincidence* can be identified as "Mūlādhāraṃ", the source of "Kuṇḍalini" at the bottom of the cerebro-spinal axis which falls at 240^0 over the human zodic. The nomenclature Mūlādhāraṃ meaning, 'Mūla the fiducial' in fact is a reflection of the fiducial longitude of 240^0 for Mūla on the Vedic Zodiac. The synonymous phraseology prevailing in Jyotiṣa & Tantra lend further credence to the above bio-celestial interpretation of the terms Mūlādhāraṃ and Kuṇḍalini.

This occult solution to the controversy as to what constitute the identity of the true zodiac raises an important question before the recommendation of the Calendar Reform Committee:

• How does Citra's opposite point make the resulting Rāśicakra an exact replica of the human being?

Neither the Calendar Reform Committee report nor the present day champions of Citrapakṣa have any answer to this vital question. CRC could not find any evidence for the existence of a true sidereal zodiac either in the Siddhāntic astronomy or in the Vedic literature. Out of the three points erroneously deciphered, one was recommended arbitrarily without any deliberations about its validity. Of course in the absence of the exact solution Citrapakṣa was certainly a good approximation.

Mūla's role as the fiducial star transcends all the limitations in view of the explicit physical and occult interpretation that is forth coming from the ancient science of Tantra. Tantra embodies the triplet of sciences Jyotiṣa, Yoga and Āgama enunciated by Lord Rudra, which consider Man as a miniature Universe. Kṣetra represents the physical body as well as the Temple housing the Tantric power Kuṇḍalini in a symbolic union or Cosmic oneness with the Cosmic Man of Time or Kālacakra conceived with Mūla as fiducial. The synonymous phraseology of Tantra and Jyotiṣa demonstrate this fundamental concordance. Tantric finds the Kuṇḍalini at the bottom of the cerebro-spinal axis, which according to Jyotiṣa marks 240^0 of the Kālapurusa. In view of the zodiacal coincidence with Mūla Tantra has designated the seat of Kuṇḍalini as *Mūlādhāra* meaning Mūla - the fiducial. In Jyotiḥśāstra the horoscope is erected with reference to the source of Kuṇḍalini and so the horoscope also came to be known as Kuṇḍalini. In the two dimensional picture of the horoscope 0^0 and 240^0 fall along the same vertical line, which signify the Merudaṇda or the cerebro-spinal axis of Man. Jyotiṣa is thus the science of correspondence of the Kuṇḍalini of the macrocosm and the microcosm – both Time as well as the human body have the Kuṇḍalini in the Mūlādhāracakra. In the absence of this bio-cosmic tie-up and correspondence that lie beyond the wisdom of the 20th century physicists, longitudes measured along the ecliptic have no meaning or caitanya in Jyotiḥśāstra. This supreme secret has remained obscure during the known history of Jyotiṣa.



VI

TĀNTRIC ASTRONOMY

"The great book of nature can be read only by those who know the language in which it was written. And this language is mathematics"

Galileo

"One reason why mathematics enjoys special esteem, above all other sciences, is that its laws are absolutely certain and indisputable while those of all other sciences are to some extent debatable…"

A. Einstein

"Thus the mechanisms of their brain reveal a deep physiological division between man and ape ... If the title of soul be given to the higher functions in question, it must be admitted that the other animals have only the glimmer of the light that so shines before men...The nearest creature to us, the chimpanzee, cannot retain an image long enough to reflect on it, however clever it may be in learning tricks or getting food that is placed beyond its natural reach. Unable to rehearse the possible consequences of different response to a stimulus, without any faculty of planning, the apes and other animals cannot learn to control their feelings, first step towards independence of environment and eventual control of it. The activity of animal brain is not checked to allow time for the choice of one among several possible responses, but only for the one reflex or conditioned response to emerge. The monkey's brain is still in thrall to its senses. Sentio ergo sum might be the first reflection of a slightly inebriated ape, as it is often the last of alcoholic man; so near and yet so far apart, even then, are they...The brain of lion, tiger, rhinoceros and other powerful animals also lacks the mechanism of imagination, or we should not be here to discuss the matter. They cannot envisage changes in their environment, so they have never sought to alter it in all their efforts to retain lordship of their habitat"

W. Grey Walter (The Living Brain, p.2)

VI

TĀNTRIC ASTRONOMY

1. A Historical Perspective on Indian Antiquity

Into the history of astronomy, perhaps I am bringing forth a new term 'Tāntric Astronomy' to describe the prehistoric phase of origin and prevalence of sidereal astronomy both in India as well as Mesopotamia. In contrast to what is conventionally known as the Vedic phase of astronomy, we have no references that have any bearing upon the Tāntric School of astronomy and therefore its features have to be deciphered out of the allegorical accounts available in the Purāṇic literature. In reality there is no such distinction between the Vedic and Tāntric Schools as far as the zodiac is concerned except that the Vedic or pursuers of the Yajña oriented way of life chose to follow a tropical calendar of which references are available in their Samhitās and Brāhmaṇas while those who pursued Tantra worshipped the sidereal zodiac or its components in numerous personified forms such as Mahākāla, Mahākāḷl etc. The origin of these two streams of the Hindu way of life is shrouded in mystery due to the lack of historical accounts pertaining to prehistory such as 3000 BC to which we credit the beginning of Kaliyuga. As we saw in chapter 2, the Hindu chronology is a bundle of confusion and no definite conclusions can be drawn about the dates of Purāṇic personages like Rāma, Kṛṣṇa, Rāvaṇa etc., or about those who had their advent in comparatively later times – like Buddha and Śaṅkara. But the Purānic literature reflects two distinct traditions and their incessant conflicts viz., Devas led by Indra and Asuras led by the descendants of Hiraṇya Kaśyap. These warring factions had as preceptors Brhaspati (Jupiter) and Śukra (Venus) and in all likelihood the War theatre was the celestial vault and the characters astronomical. Here again we are led to immense confusion as the real socially related facts cannot be grasped without an interpretation of the Purāṇic accounts which are allegorical or unrealistic. The astro-mythological accounts in the Vedas and Purāṇas can therefore be taken as only representative of a macroscopic or broad outline of the then prevalent social structure.

We have absolutely no knowledge about the personages who have presided over the society at the various epochs and the people involved in successive stages of social renaissance. What has come to be known as Vedic was apparently the Brāhmnic social order supported by certain Kṣatriya rulers and Tāntric order was a casteless non-Brāhmnic society in pursuit of knowledge and realization through Yoga. Both the traditions had great Kṣatriya sponsors and even the Vedic Brāhmins probably practiced Tantra and produced equally great Sages as the great Tāntrics, who have been the original custodians of wisdom contained in the Vedas and Vedāṅgas. Vedic accounts gives us an idea of the Ṛṣis who have sustained the tradition but no such account is

available about the Tāntric Masters. The only reliable historic account that the present author has come across is by Svāmi Sakhyānanda – here too the portrayal is more or less intuitional rather than based on any literary or archaeological records. Relying on his out line and with appropriate modifications based on the allegorical Vedic and Purāṇic accounts we may draw a rough sketch of the different cultural stages of Indian antiquity since the last ice age as:

• First Kṛtayuga since the praḷaya or ice age had its beginning in 12500 BC under Rājarṣi Satyavṛta who is also known as Vaivasvata Manu. Along with the Seven Sages (Saptarṣis) Satyavṛta founded the Tāntric cum Vedic tradition.

• Jyotiṣa, Yoga, Vedas and Vedāṅgas developed. Astronomy played a pivotal role in every aspect of life by virtue of the principle of equivalence of the microcosm and macrocosm. Terrestrial and the celestial worlds – the earth and the canopy over it – were considered equivalent and a common terminology was probably effected. Calendar based on the movements of sun and moon regulated the social and religious life and the social structure was made to conform to the annual luni – solar phenomena. As for example, Prajāpati or Brahma represented the year-beginning or vernal equinox as well as the highest authority of the society, sun became Aśva or horse and the intercalation at the end of fourth year became Aśvamedha. Intercalary days became 'go' or cows and the cardinal point at which the intercalation was effected became the lord of cows. Such symbolism based on elements of social life in which the astronomical facts were outlined later on made the Vedic and Brāhmaṇa literature unintelligible.

• In due course two Schools emerged:

(1) Ācāryas who rejected the māyā doctrine and advocated the enjoyment of life with the aid of the discovered knowledge &
(2) Those who refused to leave the path of transcendence of māyā and pursuance of mukti.

Those who sought prosperity and enjoyment of life became Devas while those who treaded the original path of Yoga became 'pūrva' Devas or Asuras. Strictly speaking the Devas were Atheists and worshipped their rulers who carried designations such as Brahma or Indra while the Asuras worshipped none other than their preceptor who symbolized Time. This split off in itself had an astronomical dimension: Devas followed the seasonal cycle or Ṛtucakra and considered themselves as constituting the northern hemisphere of the zodiac while Asuras had a zodiac of fixed signs immune to precession which formed the basis of Tantra i.e., the tripod of Yoga, Āgama and Jyotiṣa. Obviously, the calendar differed and the year beginnings were in conflict except ofcourse in rare occasions where the cardinal points coincided with the quarters of Mūla – the fiducial star of the Tāntric Zodiac, Mūlādhāra Cakra.

• In the early phase probably the two Schools coexisted and the calendar conflicts thus received allegorical description in the Purāṇic accounts. As the Purāṇic accounts invariably eulogized the victory of the Devas, it can be inferred that the authors of these

Purāṇas were affiliated to the Vaidikā Brāhmins. Similar is the case with the epics – Mahābhārata and Rāmāyaṇa – which celebrate the victory of the Devas or Vaiṣṇavas.

• Prehistoric worship of the Phallus and the personified images of the Rāśis Kanyā (Virgin), Siṃha (Lion) and the Archer when combined with the astronomical rationale of the Tāntric conception of Mūlādhāraṃ suggests an early epoch of astronomy at which the cardinal points coincided with the quarters of Mūla. By taking in to account the Vedic astronomical references as well the early epochs can be identified as:

(1) 10617BC: Summer solstice on Mūla: Original conception of Pāśupata Tantra and Sidereal Zodiac or Rāśicakra.
(2) 9550 BC: Summer solstice on Jyeṣṭhā (Indra): Seasonal cycle or Ṛtu Cakra assumed significance over Mūlādhāra Cakra in the Vedic pantheon.
(3) 4137 BC: Cardinal points back to the quarters of Mūla. Autumnal equinox coincided Mūla and the seasonal cycle merged with the Rāśis. Seasonal year beginnings and sidereal beginnings coincided and Indra lost his relevance.
(4) As the equinoxes and solstices drifted away from the quarters of Mūla, calendar conflicts surfaced again and Vaidika School celebrated the victory of Indra in the period that followed 4137 BC.
(5) 3000 BC: Renaissance in Tantra led by Nakulīśvara and compilation of Vedic hymns by Vyāsa.

• Vedic tradition dominated by Brāhmins imposed Cāturvarṇyam and was Yajña oriented while the Tāntric tradition was casteless and instituted the Āgamic idol worship for those who were not well poised to follow the difficult path of Yoga. Advent of Buddha in 1800 BC threatened the Vedic religion based on Jaimini's Karmamīmāmsa and Bādarāyaṇa countered Buddhism by adopting Yoga and achieving Yoga - Vedānta samanvaya through the Upaniṣads and the Gīta.

• Buddhists themselves adopted Tāntric precepts and thus the Mahāyānaṃ emerged.

• Brāhmins and Kṣatriyas who followed the Śaiva Āgama under the precepts of Paramahaṃsa or Nāgayatis constituted 'Brahmakṣatra-kulaṃ' or Śiva-dvijas and it was in this caste that the Ādi Śaṅkarācārya was born in 508 BC.

• In the period that followed Ādi Saṅkara Vedic Brāhmins hijacked Tantra and Tāntric institutions and became worshippers of Liṅga and Nāga.

Tantra versus Veda – Relative Antiquity

All available evidence suggests that Tantra preceded the Vedas at least in their dominance over Indian quarters. Not only the Indus civilization but also the prehistoric cultures of the Middle East have rendered remnants that point towards the prevalence of Tāntric customs and precepts. In fact the unexplainable universality of the zodiacal signs,

week days, and the common heritage that we see in the different religions such as the conceptions of soul (ātma), salvation (mukti) etc., all are borrowed from the prehistoric Tāntric religion that prevailed over the eastern half of the world. Another intriguing aspect is the worship of genitals and the serpent that we see both in Mesopotamia and in the extreme south of India viz., Kerala, where astronomy and other Tāntric disciplines too had wide prevalence since very early times. In the north of Vindhyas, the Brāhmnical religion could perhaps devour the Tāntric tradition with the aid of Uttara-mīmāmsa, Yoga and Upaniṣads as early as 500 BC – the time of Ādi Śaṅkara – and no evidence have come to us that testify such a transformation. This is not the case with Kerala, where the Vedic religion had its invasion in comparatively later times as 300 AD. The date of the first Vedic sacrifice 'Agnihotraṃ' performed in Kerala by the son of the legendary character Vararuci viz., Meḷattoḷ Agnihotri, has come down to us as a mnemonic – "Yajñasthānam saṃrakṣyaṃ" – corresponding to the Kalidina of 1270701 or Wednesday, 14th February 378 AD. This influence of the Vaidikā Brāhminism also explains the abandoning of Tāntric zodiac in Kerala astronomy by Āryabhaṭa. The contradiction that we see in Āryabhaṭa of the extra-long tropical year and the cardinal points marking the initial points of Aries, Cancer, Libra and Capricorn have no other explanation other than the shift of the epoch from AD 231 to AD 522 and adoption of the Vedic calendar beginnings and amalgamation of the same to the original Tāntric zodiac in his formulation of Siddhāntic astronomy. In the period subsequent to Agnihotri, the social fabric of Kerala underwent great changes under the rulers who sponsored Brāhminism and Cāturvarṇyam and the Brāhmins hijacked Tantra and Tāntric Institutions such as temples to impose their monopoly over priestly functions. Similar might have been the trend of happenings in the northern parts of India where Vaidikā Brāhminism adopted Tāntric practices and became the exclusive priestly class at the cost of the Tāntric tradition.

Development Profile and Personages of Tāntric Tradition

As I have mentioned above we have no source of a reliable chronology of Indian antiquity and all that we have as chronology are guess works based on confusing Purāṇic accounts. Thus going by factual information we are not in a position to ascribe any precise dates to the various stages of developments or personages who have enriched the Tāntric tradition. But still the profile that Svāmi Sakhyānanda has drawn of the development of the discipline is worth taking a notice. The salient points are:

- Yoga – Vedānta discipline had its origin from Sadāśiva and at some stage (perhaps inspired by sociological factors or may be due to intellectual conflicts upon modes of practices) the Ācārya – paraṃpara split into two: Āgama and Nigama presided respectively by the Rājarṣis and Brahmarṣis.

- Nigamikas worshipped the 'Nāda-brahmaṃ' and under the precepts of Brahmarṣis developed the 'Vedavāṇī' rooted in Chandas and in due course claimed supremacy over the Āgamikas.

- Āgamikas continued the silent pursuit of Yoga and developed the Tantrāgama śastras under Rājarṣis like Viśvāmitra, Janaka etc.

- In due course the pantheons received the appellations 'Āsuraṃ' and 'Sauram' and the latter being in possession of the Vedavāṇi could create in later times the Purāṇas that decried the former class. Also they could achieve the stylish presentation of the Yogic wisdom gained from the Rājarṣis in the Vedavāṇi as Vedāṅgas and Upaniṣads.

- Around 3000 BC Kṛṣṇadvaipāyana Vyāsa led a renaissance in the Vaidikā or Nigamika tradition by incorporating the Āgamika yoga-vedanta secrets in Sanskrit in the form of Bhagavd Gīta. Vyāsa also paved the way for Vaiṣṇava Tantra or Pancarātrāgama in the Vedic Brāhminism by creating Kṛṣṇa as the equivalent of Mahākāla Rudra in Bhāgavata Purāṇa. It was under Tāntric influence that Nārāyaṇa muni clubbed together the Dvādaśādityas and Indrādi deities in the creation of Viṣṇu as a substitute for Mahākāla and it was under the precepts of Nārāyaṇa Muni that Kṛṣṇadvaipāyana Vyāsa wrote the Bhāgavata Purāṇa, Jaya and the Bhagavat Gīta.

- Nakulīśa had his advent at the same time – a contemporary of Kṛṣṇadvaipāyana Vyāsa - and rejuvenated the Tāntric sects and the cult had its spread through Yogis to the various parts of the world. The Tāntric theatre of action was central India between Narmada and Godāvari – the precincts of Vindhyācala sought by the Rājarṣis for their penance. Different Āsuric sects created Tantravidyā – Pīṭhaṃs in places such as Ōmkāreśvar, Amarānthakaṃ, Mahākāleśvaram (Ujjain), Tryaṃbakeśvaraṃ and also resurrected the ones on the coastal areas such as Gokarṇaṃ, Rāmeśvaraṃ etc., that were lost in the geological cataclysm of 3100 BC.

- Little details have survived of the social transformation initiated by the Tāntric sects. Bhārgava Rāma is believed to have led a group of Śivadvijas of Bhṛgukacchaṃ and Nāgāyars of Vindhyācala to the south through the Koṅkan coast down up to Kerala. When combined with the legend that the Asura Mahābali had his rule over Bhṛgukacchaṃ we have here an explanation for the legends about Mahābali prevailing in Kerala. It was Bhārgava Rāma who instituted the worship of Liṅgaṃ and Nāgaliṅgaṃ in Kerala.

- Last of the regeneration of Tantra and the acceptance of Śaivāgama by Brāhminisṃ took place under the precepts of Ādi Śaṅkara, after 500 BC. Redaction of Tāntric works in Sanskrit and the Purāṇic compilation of legends so as to favor the Brāhmnic interpretations probably took place in the post-Śaṅkara period.

Even though imperfect I consider the above historic profile as a necessary background for an attempt to decipher the Tāntric astronomical epochs from the iconographic descriptions of Śiva.

2. Kāla Cakra or Wheel of Time

Time is an eternal flow, having neither a beginning nor end. Jyotiḥśāstra describe it as Kālacakra to emphasize the cyclic nature. Every perceivable moment is preceded by innumerable cycles or an "infinity of Time" and as such one moment cannot be differentiated from the other - where ever 'infinity' is involved, the computation reaches its

limit and becomes meaningless. All astronomical computations therefore require a hypothetical 'beginning' - an 'Epoch' with reference to which the successive moments can have specific qualities - that is, we need a scientific definition of the 'Origin of Time' with reference to which the Kālacakra can be mathematically conceived. Do the Indian astronomy & astrology i.e Jyotiḥśāstra has such an astronomical beginning of Time?

The question may look hypothetical and a bit puzzling but Jyotiḥśāstra answers it in the affirmative explicitly. Sūryasiddhānta I.10 reflects the etymology of the term Kāla as - "Kalanātmaka iti Kālaḥ' - meaning: Computation is the essence or the identity of time or it is computation that brings the astronomical time into existence. Further, all the classical Siddhāntas of Hindu astronomy describe Time - Cycle of Yugas - as beginning with Lord Brahma, the mythological Creator whose birth took place in Rohiṇī nakṣatra i.e., at an astronomically defined moment.

• How can the `Creator', supposedly evolving out of some kind of a void that persisted even after the praḷaya (dissolution) can have a precisely defined nakṣatra or time, for his advent?

The purāṇic story about the birth of Brahma in fact is an allegorical description of an astronomical epoch that had the vernal equinox over the Rohiṇī nakṣatra. Further pursuance of this legend leads us successively to Viṣṇu and Rudra, the latter the ultimate personification of Time, the destroyer of everything - Hara.

Ṛṣis or Tāntrics conceived the Kālapuruṣa or the Cosmic Man by a mathematical abstraction of the ecliptic using the epochal equinoxes and solstices as well as the fiducial star Mūla (Lambda Scorpii). Over this sidereal conception Mūla had a fixed longitude of 240 degrees and marked the beginning of Mūla division and the Dhanu Rāśi at the place where the celestial Ganges crosses the ecliptic. Mūla thus became Gangādhara - Rudra and a synonym of Time in Hindu mythology. Over the Cosmic Man 240^{0} became the Mūlādhāraṃ - seat of Kuṇḍalini - and also marked the position of Phallus. Cosmic Phallus or Liṅga became a symbol of Time or Rudra, and this in turn led to the 'primitive' Phallus worship. As the source of Kāla-Kuṇḍalini and Jīva-Kuṇḍalini Mūla was the crux of the disciplines of Jyotiṣa and Yoga and hence in mythology Rudra became the Progenitor or the Preceptor of these disciplines as Mahāyogi. We can see a reflection of these facts in the Mohenjadaro Seal No. M420 which depicts a three-faced Yogi in the Ūrdhva-liṅga(penis erectus) posture. The horned head dress symbolize Auṃ - the beginning of creation and according to Mundakopaniṣad Praṇava (Auṃ) is Dhanu - perphaps Dhanu Rāśi, the bow of Rudra as Pinākapāṇi.

Iconography of Śiva or **Rudra**

Iconographic attributes of Śiva as - bearer of the Serpent, three-eyed (Trayaṃbaka), Candraśekhara etc., all originated out of Mūla's fiducial (fixed reference) role over the Sidereal Zodiac. Depiction of Śiva as Sarpadhāri leads us to a very interesting rationale *behind the term "Rāśicakra". In Gujarat the present author could find horoscopes* prepared by the traditional astrologers describing the zodiac as "Phaṇīśvara Cakra" i.e.,

Wheel of the Serpent God. Elaborating this concept a bit further the term Rā - Śi Cakra can be interpreted as an acronym of "Rāhu-Śikhi Cakra" by taking the first letters Rā & Śi of the Moon's nodes. The popular appellation of the nodes of Moon as "Kāla-Sarpa" offer ample substantiation to the above interpretation. It is quite likely that Mūla-Rudra had the Nodal Serpent as a garland i.e., either of the nodes fell over Mūla at the original epoch of conception of the Mūlādhāra Cakra.

Candraśekhara, Taruṇenduśekhara (bearer of the crescent Moon) etc. also arose out of the synonymy with Time. 'Kalanātmaka iti Kālah' - We must remember that all the divisions of time computation such as Rudra-dina, Viṣṇu-dina, Brahma-dina, Kalpa, Manvantara , Mahāyuga, Saṃvatsara and Māsah begin with Śukḷa-pratipada - the first tithi of the bright half of Moon's synodical revolution. Vedas hence describe Candra as the Māsakṛd or the creator of months. The crescent Moon over Rudra's head thus signifies the epochal beginning of Time.

Further it will be interesting to note here that the correspondence/similarity between the lunation and the monthly periods of women (Ṛtukālaṃ) probably served as the first indicator of the 'bio-cosmic tie-up' and led to the Tāntric conception of the identity or symbolic equivalence of the microcosmic and macrocosmic structures. 'Ṛtu' thus symbolically stood for the beginning of 'Kāla-gaṇana' among Jīvarāśi i.e., biosphere and therefore Mahākāla adorned himself with the genitals of Gauri and became Ardhanārīśvara. The location of Mūla at the bottom of the cerebro-spinal axis is only indicative of the genitals and as such the personified Kālacakra can either be male or female. In Tantra this led to the concept of Maithuna (Sexual Intercourse), corresponding to the luni-solar conjunction. Rudra came to be looked upon as Sun and Gauri as Moon, the male and female principles.

- Viśvanātha, Sthāṇu, Mrtyu(Yama), Kālakāla, Pināki, Trayaṃbaka.

Mūla-Rudra is the crux of Rāśicakra and the attributes of the Rāśis were fixed on the basis of the theory of Guṇas and Tattvas. As the classification of the Rāśis rested solely upon the fiducial role of Mūla, Rudra attained lordship over 'Tri-guṇas' (symbolically represented by the trident) and 'Pañca-Tattvas' (symbolically the five faces or the Pentagon) and thus became Viśvanātha. There was nothing above or more than the wisdom represented by Mūla-Rudra as Tantra and Jyotiṣa together formed a 'theory of everything' in the context of creation, existence and mukti.

As regards the appellation Sthāṇu, the following paragraph is noteworthy: (1)

"We have seen that, in the Śvetāśvatara Upaniṣad, one of the epithets of Rudra is Sthāṇu. In the Vāyu Purāṇa the God practiced severe austerities standing on one foot for a whole heavenly year without taking any food. In the Matsya Purāṇa he is Sthāṇu because of his standing motionless like the trunk of tree till the dissolution of the world, or because of his refusal to move with the act of creation of mortal beings as per the instruction of Brahman. In the Mahābhārata, he is Sthāṇu because he is Sthitaliṅga. Since standing aloft, he consumes the lives of men and since he is fixed, and since his

liṅga is perpetually fixed, he is called Sthāṇu in the same work. In the Vikramōrvaśīya Kālidasa described Śiva as Sthāṇu".

It is apparent from the above that the mythology of Rudra evolved out of the Rāśicakra and its fiducial star Mūla placed over the Cosmic Phallus. Mūla is the immortal Yogi who marks out the cycles of time standing fixed and aloft and as Kāla or Hara he consumes the mortal ones.

Location of Mūla at the boundary of the 8^{th} sign over the astrological "mrtyu rekha"(0^0 - 240^0 line), (i.e., Merudaṇḍa or the cerebro-spinal axis or Mukti rekha) earned for Rudra the identity of Mrtyu or Yama or Kāla and as the mrtyu of Kālapuruṣa became Kālakāla. It is also likely that at some epoch in the remote past Mūla marked the beginning as well as end of the year as junction point of the solar months of "Kārttikā" (Vrścikā) and "Mārgaśīrṣa"(Dhanu). The deity of Mūla is Nirṛti - Lord of Pitṛs.

Rudra as the beginning of Dhanu Rāśi got described as Sudhanvāḥ or Pināki and the arrow aimed at Prajāpati (the year beginning) is visible on the opposite side of the heavens as the Orion's belt.

"Trayaṃbaka" receives many interpretations at the hands of scholars. In the context of Jyotiṣa-Rudra as the Preceptor-I'm inclined to accept the meaning - 'three-eyed' - 'Trikāladarśi' - as comprehending the Past, Present and Future - the three experiences of the mysterious flow of Time. The following description of Śiva suggests Sun, Moon and Agni as the three eyes:

"Candrārkāgnivilocanaṃ smitamukhaṃ padmadvayāntasthitaṃ
Mudrā-pāśa-Mṛgā-kṣasūtra vilasatpānim himāmśuprabhaṃ "

'Padmadvaya' signify the two ayanas that constitute the year or the day & night, Mudra refers to the Yogic posture, and Pāśa is Kālapāśa or Karmapāśa the instrument of Niyati, Mrga is the Mrgaśiras nakṣatra which is antipodic to Mūla and Akṣa-sūtra is the japamāla of fifty beads which represent the alphabets and symbolically the counting of days i.e., Kāla-gaṇana. The only factor that defies astronomical identification is Agni - the third eye. The Purāṇic account of Rudra's transformation into Nīlkaṇṭha answers this difficulty well.

Churning The Milky Way

This is an astronomical allegory involving the following characters:
Mandaragiri → Meru → Earth's axis. Vāsuki → The Celestial Equator. Devas→ Devayāna path of the Sun from the vernal equinox to the autumnal equinox. Reside at the North Pole. Asuras→ own the Pitṛyāna, autumnal to vernal equinox and the southern hemisphere. Rudra → meeting point of the two halves of Devas & Asuras at 240^0 - where the Ākāśa Ganga cuts the ecliptic. Amṛtaṃ → antidote against the ageing process of time i.e., becoming immune to the precession of equinoxes → sidereal year or zodiac.

The symbolism of Agni and the initial epoch at which the Sidereal zodiac or the "Mūlādhāra Cakra" was conceived by the Ṛṣis or Tāntrics can be gleaned from the story line that Rudra drunk the 'Kālakūta Viṣa' which symbolically represents the autumnal equinox (Agni) that divided the ecliptic into two halves. (The etymological root of Viṣa is Vi meaning - 'divides into two halves' and hence the above cryptic use of the terms Viṣa for the equinox and Serpent for the equator as they carry the Viṣa that divides the ecliptic into two halves). Further, the story mentions the rising of crescent Moon and its adornment by Rudra, creation of immortal Rāhu and Śikhi by Viṣṇu's (Sun) Cakra i.e., the conception of Rāhu-Śikhi Cakra at an epoch, which had the Sun, Moon and the Śarad-Viṣu (i.e., Agni - third eye) conjoining the fiducial star Mūla. Rudra -Śiva thus became Nīlkaṇṭha and Candramouli after the churning of the celestial Ganges.

It is apparent from the above that the mythology of Rudra and the iconography of Śiva evolved out of the Tāntric conception of the zodiac at a pre-historic epoch.

- **Initial Epoch of Mūlādhāra Cakra**

The first impulse of every historian will be to deny the existence of a fixed Sidereal zodiac as described above in pre-historic times. But with the aid of the modern computational programs it can be proved beyond doubt that an epoch reflective of the above descriptions did in fact exist in remote antiquity. The relevant details are as below:

Sidereal longitude of Mūla = 240^0
Tropical-longitude of Mūla at J2000 = 264^0 35' 8".79

Ayanāṃśa (J2000) = -24^0 35' 8".79

Rudra Epoch: Autumnal equinox of 4137 BC

UT: -4136/10/23,01^h: 14^m: 35^s JD = 210679 . 551795

Tropical Sun: 180^0 00', Tropical Moon = 177^0 25' 40"

Precession in longitude between J2000 and 4137 BC = -84^0 37' 45"

Ayanāṃśa (4137 BC) = -24^0 35' 8".79 - (-) 84^0 37'45"= 60^0 02' 36"

Sidereal longitude of Sun =180^0 + Ayanāṃśa = 180^0 + 60^0 = 240^0

(The minute difference of 2' 36" in the ayanāṃśa can be neglected, as the computation is over 6000 years interval. As such the equinox can be treated as falling exactly over Mūla)

Longitude of the descending node (Śikhi)= 196^0 54' 6" (tropical)

Sidereal longitude of Śikhi = 256^0 54' 6"

i.e., as can be expected from the mythology, the nodes of Moon fell over the Celestial Ganges across the signs Dhanu and Mithuna. Rudra or Pināki thus became the Serpent bearer and Kālacakra got named as the Rāhu-Śikhi Cakra.

It is evident that the first day of the solar month of Dhanu (Mārgaśīrṣa) coincided with the Śukḷa-pratipada and Pitṛyāna over the above sidereal zodiac and Calendar. As Rudra marked the begining of Pitṛyāna - he got the appellations such as'Śmaśānavāsi' 'Kapāladhāri' etc.)

Virocana or **Mahābali Epoch: Winter Solstice of 4136 BC**

Over the aforementioned Sidereal zodiac the Calendar could have begun from the winter solstice also. In a rare coincidence, the winter solstice subsequent to the above autumnal equinox also fell over a new Moon/pratipada and as such the year could have ideally begun with Phalguna Śukla-pratipada and the winter solstice.The epoch is:

UT -4135/January/20,04:56:25, JD = 210768.705846

Tropical Sun = 270^0, Sidereal Sun = 330^0
Tropical Moon = 278^0 48' 58"(Sidereal Moon=338^0 49')

The calendar thus began in the middle of Pitṛyāna and obviously the custodians would have been the Asuras. We can find a reflection of this fact in the story mentioned above - the amṛta-Kumbhaṃ brought forth by Dhanvanthari (note the etymological Dhanu) was taken away by the Asuras, and Devas had to take the help of Viṣṇu (Sun) later on to recover it. It will be interesting to note that Ṛgveda has the mention of a "Pūrṇa- Kuṃbha" from which time emanates.

Durgā Epoch: Summer Solstice of 4137 BC

As given under section 2, the Durgā epoch can be determined as:

UT:(-) 4136 July 25, 22:48:17,Wednesday. JD = 210590.4502

Sidereal sun and Moon were respectively 150^0 and 145^0 49' 37". The calendar might have come in force on the sunrise of Thursday.

Durga is also known as Bhadra Kāḷi - the adjective 'Bhadra' arose out of the Bhadrapāda nakṣatra (α-Pegasi of sidereal longitude $328^0$54') whose acronycal rising heralded the beginning of Kanyā (Virgo). The present day celebrations of Durgāṣṭami in the month of Bhādrapada also reflect the Durga - Rudra epochs of 4137 BC. In fact all the "aṣṭami" celebrations of the Tāntric-Vedic tradition are the remnants of earlier epochs involving cardinal points of the tropical (i.e. equinoxes and solstices) or the sidereal Zodiac (i.e., the points that mark out the quarters viz., 240^0, 330^0, 60^0 and 150^0 longitudes).

Durgāṣṭami:

At the aforementioned epoch the summer solstice coincided with new moon at the junction of the zodiacal signs Leo and Virgo. In the subsequent years the tithis of summer solstice shifted by (+) 11 and in the 17^{th} or 28^{th} year the solstice would have been on the 8^{th} tithi of bright half when Moon was in conjunction with Mūla. Ninety degrees of longitudinal separation between the cardinal points became 'aṣṭami' in mythological language (90/12=7.5 tithis).

Kṛṣṇāṣṭami:

The name itself suggests that it is of the dark half. Further we know that it is Rohiṇī nakṣatra of Sṛāvaṇa month by tropical lunar year reckoning. If we take the midpoint of Rohiṇī as the reference, the summer solstice would have conjoined with the new moon at $136^{0}40'$ and the preceding 'aṣṭaka' would have been on Rohiṇī. Kṛṣṇa as such may represent an epoch at which the summer solstice coincided with the 8^{th} tithi of the dark half of Śṛāvaṇa.

Bhīṣmāṣṭami:

Bhīṣma or Gangadatta is the Mūla nakṣatra and the Mahābhārata is a sidereal versus tropical calendar conflict. Kṛṣṇa won the conflict and Bhīṣma even though invincible allowed the calendar to be tropical by quitting his fiducial role on the winter solstice day. Bhīṣmāṣṭami therefore represents the winter solstice coinciding with 8^{th} tithi of the bright half of Māgha at which a new tropical calendar came in force.

The name Durgā is generative of a lot of confusion due to the innumerable legends associated with it in different regions. A concrete prototype of this Goddess remains to be carved out of her salient features. Mūlādhāra Cakra brought into existence domains having fixed shapes and attributes like the Rāśis and many astro-mythological legends subsequently evolved around them. Unfortunately with the passage of time and the degeneration of the academic standards of the society the astronomical rationale of the legends have got obliterated and quite a lot of non-sense fantasies got imposed over it to make the identification of their true astronomical origin very difficult. Durgā is a typical example illustrative of the above facts. She has come to share everyone's features like Pārvati, Umā, Lakṣmi etc. and this makes the identification impossible. But if we can restrict ourselves to certain prominent attributes only, the task becomes very easy.

1. According to the Devīmāhātmya of the Mārkaṇḍeya Purāṇa (Ch.81-93), She is the creator of Brahma - Viṣṇu - Maheśvara Trinity and hence the Mahākāḷi i.e., the Great Goddess of Time. She is the equivalent of Rudra but not his consort.

2. She rides over Lion and was born to kill the Mahiṣāsura (Buffalo-demon). She wears the garlands of skulls, holds Triśūl and other insignia of Śiva, Viṣṇu etc. Note the parallelism with the Hari-Hara putra, who killed Mahisi - the wife of Mahiṣāsura.

3. She is the Virgin - Kanyā Kumāri. Kumāra and Kumāri are terms indicative of fixity of position and form. Note the parallelism with Kumāra svāmy alias Skanda and Kumāra Śāsthā (Kutti-Cāttan in Malayalam) who is son of Rudra & Viṣṇu Māyā.

Against the background of Section 2, Kāḷi-Mahākāḷi (Mahābhārataḥ IV:6:25) of the above attributes especially the Virgin Mother of Rudra - is the epoch of solar transit into Kanyā Rāśi at the sidereal longitude of 150 degree. Hari-Hara-putra represented the east-west course of the solstice at 150 degree while Durgā is the sidereal solar epoch beginning with the same longitude with Mūla as fiducial.

Legend of Hari-Hara Putṛa

Recovery of the amrtaṃ (or Calendar) by Devas with the help of Viṣṇu as Mōhini and the birth of a son for Rudra and Mōhini in Uttaraphālguni nakṣatra also refers to the year-beginning at summer solstice falling at 150^0 of the Sidereal zodiac. Viṣṇu as Mōhini is the sun entering Kanyā Rāśi and Rudra is Mūla as before. Hari or Viṣṇu is also the Siṃha Rāśi and hence the solstice falling over 150^0 became Hari-Hara Putra in mythology. Moreover this deity is Pulivāhana i.e., rides over Lion (cryptic reference to the sign Leo) and Brahmacāri - averse to women - as the solstice has already moved over the Kanyā Rāśi from east to west and also Kanyā being mother as Mōhini from a different angle.

Astronomy underlying the legend of Hari-Hara Putra finds a beautiful demonstration in the Śabrimala Śrī Dharma Śāsthā Temple of Kerala. In clear-cut symbolism with the Mūlādhāra Cakra, the deity is Yogaroodha (in Yogic posture) and sits over 18 holy steps that signify the 18 steps of Yogavidyā as well as the ascent of Kuṇḍalini from Mūlādhāraṃ (240^0) to Śīrṣa-padmaṃ (0^0) over the cerebro-spinal axis. These 18 steps are indicative of the fiducial star located at the end of the 18 stellar divisions i.e., 18 x $13^0 20'$ = 240^0. Further it is customary that the devotees must carry with them a coconut (three-eyed) as representing the Trayambaka-Rudra. The first visit to the shrine receives the appellation Kanni (Malayalam term for Kanyā). This is reflective of the year beginning with Kanyā Rāśi and the tradition prevails even now in Malabār (North Kerala). Legends depict the avtar of Śāsthā as an Archer riding over lion (Indra assumed the form of a lion along with other Devas) who shoots an arrow to the Śabari hills to pinpoint the location of his divine presence. This is reflective of the Rāśis Dhanu and Siṃha and the Orion's belt that we see opposite the sign of Archer. Śāsthā is also described as 'Tāraka Parabrahmaṃ'* an appellation often credited to Kumāra Kārttikeya, who is another mythological representation of Mūla. Paraśu Rāma who instituted the worship of Śāsthā in Kerala was a proponent of the Tāntric tradition and till the beginning of the last century the Brāhmins used to keep away from the shrine as it was open to all irrespective of any caste considerations.

* Dhyānaṃ is: Kālāśva saṃsthitaṃ Śūlacakrādyāyudhamaṇḍitaṃ
Sarvadevamayaṃ devaṃ Tārakaṃ taṃ bhajāmyahaṃ I

3. Āgrahāyaṇī and Mūla

Even though the initial epoch of Mūlādhāra Cakra corresponds to the Orion epoch suggested by Bālagaṅgādhara Tilak the underlying astronomical conceptions are diametrically opposite in the present case. Appropriate revision of Tilak's analysis provides us with more corroborative evidences to establish the origin of sidereal zodiac in BC 4137.

a) Tilak's hypothesis

Taittirīya saṃhitā describes Citrā & Phālguna pūrṇimā as the year beginnings along with Māgha-pūrṇimā in apparent contradiction. As the year then commenced on the winter solstice, such year - beginnings were impossible at the same time and so the verses may be reflective of older traditions just as now the Brāhmins performs their sacrifices on days and times fixed at the time of Kṛittikā - equinox[∞]. To establish the older tradition of winter solstice on Phālguna-pūrṇimā[φ] and the vernal equinox coinciding with Mṛgaśiras, Tilak had adduced the following arguments:

1. Amara Siṃha and Pāṇini give Āgrahāyaṇī as a synonym for Mṛgaśiras nakṣatra and on this basis Pāṇini considered Āgrahāyaṇika as a derivative word for the month of Mārgaśīrṣa. Lexicographers trace the origin of this word to Mārgaśīrṣa-pūrṇimā, which was the first night of the year - came to be called Āgrahāyaṃ - and as this full moon occurred in the month of Mārgaśīrṣa the month itself subsequently gained the name Āgrahāyaṇika. The ordinary practice was to name the full moon after the nakṣatra rather than naming the nakṣatra in the reverse manner over the full moon i.e., Āgrahāyaṇī had to be the first full-moon night of the year but here in contradiction it stands for the nakṣatra and defies satisfactory explanation. Pāṇini gives no authority for this converse process and the term Āgrahāyaṇi is used in the sense of a full-moon day. Therefore it was suggested that Āgrahāyaṇi might have been derived from Āgrahāyaṇa which may be the original name of the Mṛgaśiras nakṣatra.

2. Amara Siṃha was not alone in misconceiving the meaning of these old words. Mārgaśīrṣa full moon as the first night of the year had been the source of many other errors in the later literature. Kṛṣṇa's statement in the Bhagavad Gītā X.35 – Masānāṃ Mārgaśīrṣohaṃ - is based on the etymological misconception of the meaning of Āgrahāyaṇika as the first of the months and later writers like Amara Siṃha and Vāgbhaṭa simply followed the Gītā in assigning the same position to the month of Mārgaśīrṣa. Āgrahāyaṇika is really a derivative word and cannot therefore mean that the respective month was the year beginning just as Jyeṣṭhā does not mean the eldest month.

[∞] Evidence for placing the vernal equinox in the Kṛttikās consisted of: (1) Listing of the nakṣatras beginning with the Kṛttikās (2) Winter solstice falling in the month of Māgha (3) Nakṣatra at the summer solstice being presided over by the Pitṛs and (4) Nakṣatra at the autumnal equinox – Viśākhā – as implying a division by the equinoctial coloure.

[φ] Year beginning / Winter solstice on Phālguna Pūrṇimā meant the vernal equinox near Mṛgaśiras, autumnal equinox over Mūla and summer solstice on Uttara Phālgunī.

3. Epochs having winter solstice or vernal equinox coinciding with the Mārgaśīrṣa full moon are untenable due to the distant antiquity involved.

4. Āgrahāyaṇi or Āgrahāyaṇa - both give the same meaning that the year commenced with the nakṣatra of Mṛgaśiras.

5. Tilak's noteworthy conclusions are:

(a) "Corresponding to the winter solstice in Phālguna, we thus have the asterism of Mṛgaśiras or Āgrahāyaṇa to commence the year from the vernal equinox, much after the same manner as the Kṛittikās were said to be the mouth of the nakṣatra when the winter solstice fell in the month of Māgha".

(b) Mūla was so called because its acronycal rising marked the commencement of the year when the vernal equinox was near Mṛgaśiras and the winter solstice fell on Phālguni full moon. Āgrahāyaṇa setting with the sun in the west and Mūla rising in the east then marked the beginning of the year and this position of Mūla is likely to be specially noted, as the heliacal rising and setting of a star and so of Āgrahāyaṇa is difficult to be accurately watched. The etymological meaning of Mūla may thus be said to supply a sort of corroborative evidence for placing the vernal equinox in Mṛgaśiras...."

Refutation of Tilak's Hypothesis

1. No etymological misconception by Kṛṣṇa or Vyāsa

Mūlādhāra Cakra and the first epoch described earlier nullify the criticism of Kṛṣṇa by B.G.Tilak. Kṛṣṇa in fact refers to the year beginning with the autumnal equinox or perhaps he had in his mind the sidereal solar year beginning with the Mūla-saṃkṛama i.e., the solar month of Dhanu or Mārgaśīrṣa. The nomenclature Mārgaśīrṣa arose out of the full moon as per the well-known practice.

Mṛgaśiras as Āgrahāyaṇi

Sidereal longitude of Mūla = 240^0
Sidereal longitude of Mrgaśiras = 59^0 07'

Both these stars have no proper motion and so they must have been relatively in the same position at the epoch of 4137 BC. It can be understood from the above positions that the acronycal rising of Mṛgaśiras in fact marked the impending transit of sun over Mūla on the next day and thus the Year-beginning. That is, the year began with the autumnal equinox or fiducial star under the guidance of Mṛgaśiras nakṣatra and hence both the titles Āgrahāyaṇi and Āgrahāyaṇa find ample justification. There remains no room for the reservations raised by Tilak.

We can see the remnants of an year beginning with autumnal equinox in the present day celebrations of Navarātri (worship of Śārada) and Dīpāvali.

The year beginning with the acronycal rising of Mṛgaśiras receive a clinching evidence in support from the iconography of Śiva as holding the crescent Moon as well as Mṛga.

- Evidence of the Avesta Calendar

The Avestan calendar also had a sidereal beginning in 4137 BC and the first month was solar Kanyā (Virgo) similar to the Malabar tradition mentioned earlier. The Iranian practice of dedicating the month *Dathusho* to the Creator i.e., Time personified in essence can also be explained on the basis of the Mūlādhāra Cakra. The solar month of Gemini in BC 4137 began with the vernal equinox and coincided the acronycal rising of Mūla i.e., Rudra or Creator - the personified astronomical beginning of Time - and hence the dedication of the month to Ahuramazda. When the original sidereal calendar got corrupted due to some historical reasons like the adoption of tropical calendar due to precession, the above practice got attached to the vernal equinox and the true rationale of the 'Creator' went into oblivion.

4. Ancient Astronomical Conflicts & Allegories

(a) Kārttikeya - son of 'Agni -Rudra' and Gaṅgā.

Kārttikeya, mythologically the son of Rudra and Gaṅgā fostered by the six Kṛttikās is the deity presiding over Jyotiṣa. In the south he is also known as Kumāra Svāmy - an eternal bachelor. 'Kārttikā', the foster mother can be identified as the solar month of Vṛścikā and the son of Gaṅgā is obviously Mūla. The six faces of Kārttikeya or the six petals Lotus in which he was born is the year of six seasons.

An interesting meaning of the term 'Kumāra' as prevalent in ancient times may be understood from Ṛgveda I.155.6, which describes sun as 'Yuva' (young) but 'Akumāra' meaning revolving round the earth. Obviously 'Kumāra' meant, "fixed". It is therefore likely that the appellation 'Kumara' for the son of Ganga probably originated out of its fiducial role i.e. fixed position serving as a reference. It must also be noted that the Vedic literature refers to Yama also as 'Kumāra'. Another piece of evidence is available in the epic character Bhīṣma who is also portrayed as a 'bachelor' son of the Ganges. Gangāputra is pledged to remain a bachelor to facilitate the inheritance of the crown by the son of Matsya-kanyā (an allegorical term indicative of the zodiacal signs Pisces and Virgo). The death of Bhīṣma by his own choice at the beginning of the winter solstice is a description of the calendar reform by adopting the Winter solstice as the year-beginning.

The true astronomical identity of Kārttikeya can therefore be fixed as Mūla. Birth of Kārttikeya has no connection at all with the fall of vernal equinox over the Kṛttikās as had been interpreted by many scholars. The legends regarding the birth of Kārttikeya fully reflect the identity as Mūla. Mahābhārata (111:228:30-1) specifically mentions that Rudra entered Agni and created Skanda. Further at Mahābhāratah (XIII: 83:11-13) Brahma tells the gods that the Tārakāsura could be slain only by the son born of Rudra's seed falling in Agni and then conceived by Gaṅgā. Rāmāyana also mentions the same story. The child

was brought up by the 'Kṛttikās' -the Kārttikā solar month that preceded the solar transit over Mūla. Agni's identification with Rudra also arose out of the fall of autumnal equinox over Mūla. Ṛgveda X: 17:3 say: "Agni submits to the Devas those who have died" - it is obvious that Agni guards the portals of Pitṛyāna as the autumnal equinox.

Identification of Agni in Mahābhārata

In identifying the Tāntric epoch from the iconography of Śiva and also in understanding the legends about Kārttikeya, we have assumed Agni as representing the autumnal equinox. A few Vedic references that validate such an interpretation have been already given above. A detailed look at the Mahābhārata account on the role of Agni and Agni's identity is attempted below:

Mahābhārata Vanaparva, Chapters 223 – 221:* "Chapter 223 introduces Indra rescuing Devasenā from the clutches of Keśin. On being freed Devasenā demands a husband for herself. Indra goes out in search of one. In chapter 224, Indra beholds Soma entering into the Sūrya, wherein also is entering Agni; and he thinks that the product of such a unique combination of the three luminaries might turn out to be the most dazzling one; and as such, he alone would deserve Devasenā's hand. Brahma concurs. Indra thereupon goes to the seven sages, who are busy with sacrifice and whose oblations the gods are eagerly waiting through Agni, their appointed messenger. The sages offer oblations into the fire. Agni comes out from the sun's orb to receive them; but when he is emerging from the orb, his eyes fall upon the wives of the sages. The impassioned Agni caresses the aura of their grace; but unable to enjoy their person, he retires into forest to commit suicide. While the Agni languishes in forest Svāha, the daughter of Dakṣa, approaches him disguised as Śivā, the wife of Aṅgiras and ravished by Agni, Śivā assumes the form of Suparṇī or Garuḍī and flies to the Śveta mountain, adorned with reed-thickets and there she deposits the voluptuous flame in a golden kuṇḍa. Born of Agni's semen, discharged into Svāhā, who approaches Agni in the guise of the six wives of the sages, the Kumāra arises and he roars and splits asunder the Krauṅca Mountain and eventually subdues the entire creation.

Chapter 226 introduces Viśvāmitra performing various rites for the Kumāra. He alone knows the secret of Svāha as Kumāra's mother. The sages are ignorant of the trick played upon their wives and they discard them. Chapter 227 presents Indra at first angry with Skanda and then seeking concord with him. Chapters 228-229 are a glorification of Skanda with mention of Umā....Skanda is chosen as Commander of the gods' armies....Indra now remembers Devasenā and he offers her in marriage to Skanda, who subsequently marries Śrī also".

Chapter 228, also contains the description of Skanda as goat-faced:

Ṣaṣṭaṃ chāgamayaṃ vaktraṃ Skandasyaiveti viddhitat I
Ṣaṭśirōbhyantaraṃ rājan nityaṃ mātṛgaṇārccitaṃ II228-13 II

* Translation by Dr. Sūryakānta

- Mahābhārata treats Agni and Svāhā as equivalent to Rudra and Umā (Dākṣāyaṇī):

  Rudreṇāgnim̩ samāviśya Svāhāmāviśya cōmayā I
  Hitārttham̩ sarvalokānām̩ jātastvamaparājitāḥ II 231-9 II

Other notable aspects of the Kārttikeya legend as noted by Sūryakānta is:

- "The one point that stands out in this account is the importance assigned to Agni and Svāhā, whose union in the sacrificial *kuṇḍa* is repeatedly praised as the one source of creation and sustenance of the world. It is this aspect of sacrifice that is symbolized by the timeless legend of Kumāra...".

- Yudhiṣṭhira's question and Mārkaṇḍeya's answer point towards the discrepancies that may arise in Purāṇic narratives:

  Kumārastu yathā jatō yathā cāgneḥ sutōbhavat I
  Yathā rudrāccasam̩bhūtō Gaṅgāyām̩ kṛttikāsu ca II
  Etad iccāmyaham̩ śrotum̩ kautūhalamatīva me II

Even though Yudhiṣṭhira wanted to hear about the roles of Agni, Rudra, Gaṅgā and the Kṛttikās in the birth of Kumāra, the answer of Mārkaṇḍeya is restricted to Agni, Svāhā disguised as Śivā and the Kṛttikās with no reference to the Gaṅgā. But it is evident from Yudhiṣṭhira's inquiry that Gaṅgā did play a role in the birth of Kumāra and the omission in the narrative of Mārkaṇḍeya may be due to over sight on his side or loss of the relevant astro-mythological information by the time of redaction of the extant version of Mahābhārata. This is one of the dangers that we have to face while attempting to decipher the astronomy inherent in puraṇic narratives.

Identification of Agni in Śatapathabrāhmaṇa

We saw above the identification of Agni as Rudra-Śiva in Mahābhārata and are thus able to link Kumāra Kārttikeya as a personification attempted by the Vedic pantheon of the Tāntric god Mahādeva Rudra who is none other than the fiducial star of the sidereal zodiac viz., Mūla. In the portrayal of Bhīṣma we have the same astronomical basis and so the similarities in the descriptions cannot escape one's attention. The following observation of Sūryakānta is illustrative of this point:

" Of the many problems posed by the Kumārasam̩bhava, the problem of the hero himself has proved ponderous; for he is an exceptionally complex personality – odd in birth, perpetually youthful, active and rigidly restrained in life, standing alone for ever in vibrant equilibrium of the highest fervor as did in later ages, that of his brother, the Gāṅgeya Bhīṣma, the immaculate celibate of the epic fame. The more one studies this "Timeless Child" in the light of the present work, the more exhilaratingly can one detect him at the hub of the universal wheel, turning it and evolving therewith the infinity that passes comprehension".

It is therefore apparent that the identification of Kārttikeya with Time is rather straightforward than indirect. The identification that we receive for Agni in Śatapathabrāhmaṇa reinforces this aspect:[∞]

" Śatapatha, VI.I.II, defines Agni as:

Athayo garbhōntarāsīt sōgrir asṛjyata sa yad
Asya sarvasyāgram asṛjyata tasmādagrir agrir havai
Tvāmagniriti acakṣate parōkṣaṃ parōkṣakāmāhi devāḥ II cp. Also ŚB., II.2.4.2

Because it is born at the beginning; therefore it is called Agri; Agri is Agni. The basis of this appellation is hidden; for the gods have to be elusive and esoteric; and they are ever indirect and mystic.

The Mahābhārataḥ 224.28-29 describes Vahni as coming from the orb of the sun. We have it expressly stated by the Vāyu Purāṇa, chapter 31:

Ṛturagnistuyaḥ proktaḥ sa tu saṃvatsaro mataḥ I
Ādityeyastvasau sāraḥ kālāgniḥ parivatsaraḥ II 29 II

Agni is ṛ - tu; for it constantly moves (√ṛ = 'go'); it is saṃ-vat-sara; for it encompasses (√vas = 'clothe') creation and also the time divided into months. It is the essence of Āditya; it is Kāla; for it counts while it burns (√kal = 'count'); it is pari-vat-sara 'the all-round encompasser'.

The point to be signalized here is the identification of Agni with Kāla, for which cp. Vāyu Purāṇa:

Brahmāviṣṇuścayajńśca kālasyaiva kalāstrayaḥ I
Sarveṣvevahi kāleṣu caturmūrtir maheśvaraḥ II 33-22 II

Ahaṃjanojanayitā vaḥ kālaḥ kālapravartakaḥ I
Yugakartā tathā caiva paraṃ paraparāyaṇaḥ II 33 –23 II

Eṣakālaścaturmūrtiścaturdaṃṣṭraścaturmukhaḥ I
Lokasaṃrakṣaṇārthāya atikrāmati sarvaśaḥ II 33 –28 II

Nāsādhyaṃ vidyate cāsya sarvasmin sacarācare I
Kālaḥ sṛjati bhūtāni punaḥ saṃharatikramāt II 33 – 29 II

Sarve kālasya vaśagā na kālaḥ kasyacid vaśe I
Tasmāt tu sarvabhūtāni kālaḥ kalayate sadā II 33 – 30 II

[∞] As quoted by Sūryakānta in 'Kālidāsā's Vision of Kumārasaṃbhava', pp.32-33.

Agni is Kāla; it is born at the beginning; the moment it starts functioning (√aj = 'drive' or √aṅj = 'anoint') it becomes Kāla (√ kal = 'count'), i.e., it develops into that, which counts while it creates; the two functions of Agni being indivisible.

This significance of Kāla is typified in the Vāyu Purāṇa in chapter 30:10-22:

Kālāvasthāstu ṣaṭ teṣāṃ māsākhyā vai vyavasthitāḥ I
Ta ime ṛtavaḥ proktāscetanācetanās tu vai II 10 II

Prajāpatiḥsmṛtōyastu sa tu saṃvatsaro mataḥ I
Saṃvatsarasmṛtohyagniḥ ṛtaṃ ityucyate dvijaiḥ II 21 II

Ṛtāt tu ṛtavoyasmājjajṅire ṛtavas tataḥ I
Māsāḥ ṣaḍ ṛtavojṅeyās teṣāṃ paṅcartavaḥ sutāḥ II 22 II

Agniṣvāttā barhiṣadaḥ pitaro dvividhāḥ smṛtāḥ I
Jajṅāte ca pitṛbhyastu dve kanye lokaviśrute II 27 II

Menā ca dhāriṇī caiva yābhyāṃ viśvamidam dhṛtaṃ I

The purport is: Agni, evolved as Kāla, is ṛ - tus; these constitute saṃvatsara, the origin of creation in its various forms: the Pitṛs, the sons of the ṛ - tus, give birth to two daughters: Dhāriṇī and Menā, who create this world.

It is, thus, Agni, identical with Kāla, which works through the six seasons..."

Deciphering the astronomical basis of prehistoric legends or Purāṇic accounts is a very difficult task as we are ignorant of the cryptic terminology and method employed in the mythological narrations. In fixing the original Mūlādhāra epoch identity of Agni as autumnal equinox had a critical role that was open to criticism by Vedic scholars who will be in possession of other numerous identifications of Agni. The most generally accepted identification is of course the one that suites the standards of a primitive society i.e., the fire, which can make the interpretation I have made a most absurd play of imagination. It is to avoid such a predicament that the above long discussion has been incorporated on the true identity of 'Agni' as appearing in Hindu mythology.

The story of Kārttikeya probably reflects the effort of the Vaiṣṇava pantheon and the followers of seasonal calendar to incorporate the Tāntric significance of Rudra into their traditions. Tārakāsura can only be the Mūla appearing in the Tāntric tradition and it got re-christened, as Kārttikeya for adoption in to the Vedic fold with the appellation "Tāraka Parabrahmaṃ". The epoch of 23.10.4137 BC had the year beginning at autumnal equinox falling over Mūla at 240^0, where the Ākāśa Gaṅgā cuts the ecliptic. In mythology the epoch was made into a cosmic drama involving Agni, Rudra, Gaṅgā and the Kārttikā month that preceded the epoch to adopt Mūla as Devasenāpati in view of the critical significance it had in the establishment of calendars. It is possible that before the fall of autumnal equinox or Agni over Mūla, Mūla was looked upon as Tāraka – Asura by those

who have followed the tropical calendar and subsequently when the cardinal points coincided with the quarters of Mūla legends were created to adopt him as a Deva.

With the fall of autumnal equinox, Mūla became the boundary of Devas and Pitṛs (Devayāna and Pitṛyāna) and this is reflected in the fact that the deity of Mūla is Nirṛti - the synonym of death. Mūla thus became the "cremation ground" and Agni that takes sun to the south became Yama. Śatapatha Brāhmaṇa VII: 2:1:9: 'Yama doubtless is Agni and Yami is the Earth' – substantiates the above interpretation. All such descriptions were true at the Mūlādhāra epoch of 4137 BC as the original conception of Pitṛyāna prevailed at that time and Agni was in conjunction with Rudra. Another remarkable aspect of Nirṛti is the symbolism with dove - 'Kapōṭa'. According to Ṛgveda X: 165:4, dove is Yama's messenger and "Nirṛti-putra Kapōṭa" is the seer of this hymn. Nirṛti is also Earth and all that is burnt or dead belongs to her. Further, Śiva and Pārvati are known to have assumed the form of doves (Kapōṭeśvara and Kapōṭeśvari) - Pārvati is the Durgā referred earlier - daughter of the mountain Meru - North pole - summer solstice at which Sun attains maximum declination. All these mythological inter-connections and their convergence to Mūla personified as Rudra-Śiva substantiate the original epoch of Mūlādhāra Cakra we have identified earlier.

(b) Dakṣa yajńa-bhanga

Dakṣa Prajāpati is one of the most important astro-mythological characters being the father of the 27 wives of Moon. Astronomically Dakṣa is the Abhijit nakṣatra or Vega (Alpha-Lyrae) of sidereal longitude 260^0 43' 50" and latitude (+) 61^0 44'. In 5654 BC Dakṣa-pūrṇimā marked the vernal equinox as well as the year beginning and hence Dakṣa became Prajāpati - a synonym of the year. The word Yajńa is also a synonym of the Ṛtu-saṃvatsara and Dakṣa-yajńa or the practice of the year beginning with the Dakṣa-pūrṇimā in due course became obsolete due to the precession of the equinoxes. We can find in Vāyu Purāṇa an explicit mention of this fact:

"After a thousand parivatsaras, the Gods lost track of time. They were perplexed and went to Mahākāla- who fixed an epoch for them."

It must be noted here that the terms Prajāpati, Yajńa etc. are specifically related to the year or the Ṛtu-saṃvatsara only and have no connotation as Time or Kāla. On the other hand Rudra receive the specific mention as Mahākāla. The above statement that Mahākāla fixed the epoch for the Gods is suggestive of his fiducial role as Mūla. According to legends Rudra cut-off the head of Dakṣa and subsequently a goat's head was used to revive him. This goat's head can possibly be the sidereal year that began with the Meṣa Rāśi i.e., the goat-head (Aśvini).

It is a very rare astronomical phenomenon that in the year 4137 BC the summer solstice and the autumnal equinox coincided with the new moon, while the subsequent winter solstice was on the Śukḷa-pratipada. These computed epochs do have another astronomical substantiation in the fact that the summer and autumn had durations of only 89.18 and 89.08 days respectively in 4000 BC. That is the sun could move across 180

degrees in six lunations from the summer solstice to winter solstice or each lunation had a solar arc of 30 degrees i.e., "Rudra" had an express provision - a lunar scale - to mark the boundaries of the Rāśis.

(c) Rudra shoots 'Prajāpati' and makes him 'Mṛga' or 'Mṛgaśiras'

Prajāpati is Yajña or Ṛtu-saṃvatsara i.e. the tropical year that had its beginning with the vernal equinox falling in the constellation of Orion. With the establishment of the sidereal zodiac vernal equinox and Prajāpati lost their significance and instead the beginning of the new sidereal year was heralded by the acronycal rising of Mṛgaśiras and hence the 'pierced Prajāpati' rose to the heaven as Mṛga or Mṛgaśiras. The arrow - Pāśupatāstra - is the belt of Orion. Mṛga then became a part of Rudra's (Time or calendar personified) insignia by virtue of its acronycal rising.

All mythological references to Archer and the Arrow shot by him refers to the zodiacal sign of Sagittarius and the Orion's belt placed opposite in the sky.

(d) Tripura - dahana

Like the above, this legend also originated with the siderealists i.e. the Tāntric cult. The three cities roaming in heaven were shot at when they came on a straight line; the three cities were the cardinal points of the tropical zodiac i.e. the two solstices and the vernal equinox which coincided with the quarter guards 330^0,$60^0$and 150^0 of the sidereal zodiac. The single arrow shot at Prajāpati deprived all the three cardinal points of the Ṛtu-saṃvatsara of their significance.

(e) Conflict of the 'Ayanas' and Sidereal versus Tropical Zodiac

In the popular Siddhāntic astronomy we can find the two halves of the year as:

Uttarāyana: Winter to Summer Solstice.
Dakṣināyana: Summer to Winter Solstice.

Whereas in the Śatapatha Brāhmaṇa (II.1.3) we see:

"Vasanta, Grīṣma, Varṣa are the Deva-ṛtus while Śarad, Hemanta and Śiśira belong to the Pitṛs... when sun moves to the North he is amongst the Devas while in South amongst Pitṛs".

This passage is reflective of an earlier tradition, which considered the 'Devayāna' as from the vernal to the autumnal equinox and Pitṛyāna the remaining half. With the establishment of the Sidereal Zodiac this led to the division of the Mūlādhāra Cakra into two permanent halves of the Devas and the Dānavas (Pitṛs).

i.e., Devalokaṃ: 60^0 - 240^0 (sidereally)
Pitṛlokaṃ : 240^0 - 60^0.

Over this fixed zodiac the four quarters had the guardian deities: (Matsya Purāṇa Ch. 124)

Yama (Agni)	:	South (240^0)	
Indra	:	North (150^0)	
Soma	:	East (60^0)	and
Varuṇa	:	West (330^0)	

The system could not remain uncorrupted for long. Pitṛyāna got confused with Dakṣiṇāyana and Yama got shifted to the summer solstice in the tropical calendar with the passage of time. Thus the dark fortnight of Bhādrapada came to be regarded as sacred for the Pitṛs (Mahālaya Pakṣa). But the earlier association of Pitṛs with the autumnal equinox finds its reflection in the secondary Mahālaya Pakṣa observed in the dark fortnight of Aśvina, which culminate with Naraka Caturdaśi when the Pitṛs are supposedly sent back to their world. This particular observance thus reflects the *obliteration of rationale due to both the 'ayana' conflict as well as the 'tropical'* interference. Lord Kṛṣṇa symbolized the vernal equinox and thus in mythology of the tropicalists Kṛṣṇa appears as a protagonist of the tropical calendar and this is reflected in the so-called destruction of Narakāsura (Mūla nakṣatra) at the hands of Kṛṣṇa. It is interesting to note that the seat of Narakāsura was the Kāmākhyā hills - the stronghold of the Tāntric cult.

It must be noted here that the epochs I, II and III of Mūlādhāra Cakra had been both sidereal as well as tropical in view of the coincidence of the cardinal points of both the systems i.e., the sidereal and tropical year-beginnings could have been the same. For example: The beginning of Kanyā (Virgo) could have served as the initial point of a sidereal solar calendar similar to the Kerala tradition as well as that of a tropical lunar calendar like the North Indian tradition beginning with Caitrādi. Only the intercalation process differed in both systems - but with the passage of time the equinoxes and solstices receded from the above sidereal junction points and both the calendars ceased to have any harmony between them. The year-beginnings shifted apart and thus arose the great conflicts between the Devas and Asuras. In the context of calendar two distinct *traditions viz., Sura Gaṇana (tropical - lunar) and Asura Gaṇana (sidereal - solar)* thus originated in India in pre-historic times and the conflict between these two practices became the prime source of legends and the Purāṇic mythology.

Mahābali versus Indra

At the Mūlādhāra epoch summer solstice was at 150^0 and it marked the year beginning of a tropical calendar among the Vedic tradition / Vaiṣṇavas in the north of Vindhyācala. Indra represented the above summer solstice. Mahābali on the other hand symbolized the longitude 330^0 - the junction of Kumbha and Mīna Rāśis with which a sidereal solar Calendar began in the Narmada belt among the Tāntric cults. This identification receives additional support from the fact that Durgā Devi (Sidereal calendar that began with Kanyā Rāśi) is described as 'Vairocani' (Virocana's daughter) in Taittirīya Āraṇyaka X:1.

Virocana is the Asura King who had 100 children – Kuṃbha Rāśi which holds the Śatatāraka - and also the father of Mahābali. As Virocana's 'Asura-putra' and 'Sura-putri' (Devi), Bali and Durgā can only be the antipodic longitudes 330^0 and 150^0. Durgā as Kanyā Rāśi represents the sdereal zdiac and so do not appear on the Indra's side in his conflict with Bali.

Indra lost his sovereignty due to the prevalence of the sidereal calendar independent of the receded solstices. This loss could be avenged only after the advent of Viṣṇu as 'Vāmana' on the 12th tithi of the bright half of Bhādrapada i.e., on Śrāvaṇa nakṣatra known as Hari or Viṣṇu. Also this constellation represents the three footsteps of Viṣṇu and is the Garuda (known as Vulture in the West). The legend refers to beginning of a tropical calendar from the summer solstice that coincided with Bhādrapada Śukḷa-dvādaśi. People of Kerala celebrate this event as Ōṇaṃ in memory of the golden rule of their King Mahābali and his defeat at the hands of Viṣṇu (Sun) by deception. The longitude of 330^0 also signifies the Pātāḷa as the midpoint of Pitṛyāna. Combined with the fact that the historical Mahābali had his kingdom in the Narmadā belt, the reminiscence in Kerala of Mahābali as their emperor is suggestive of migration of the Tāntric cults from Narmadā belt to the south.

Another clinching evidence in support of the above identification is the 'Bali-Pratipada' (Bali's astro-mythological ascension to the throne) known also as 'Dyūta-pratipad', which follows Yakṣa-rātri, the night of the new moon of Kārttikā. Bali-pratipada also marks the beginning of Vikrama Era prevalent especially in the Narmadā belt. Further the Dyūta – pūrṇimā celebrated on the full moon night of Āśvina reflects the original association of the festival with the autumnal equinox. A relic of the original practice can also be found in the Ugaritic lunar Calendar of 1300 BC that started with the first day of 'ris yn' - the new moon nearest to the autumnal equinox. The practice must have started with an original epoch at which the new moon coincided with the autumnal equinox. The month began at sunrise on the day of first crescent invisibility (as in Egyptian tradition) or at sunset on the day of first crescent visibility as in the Babylonian style. The present day celebrations don't have their original astronomical rationale due to the Siddhāntic/ tropical modifications that have taken place around the beginning of the Christian era.

As can be understood from the epochs given earlier, the Kārttika new moon of 4137 BC coincided with the acronycal rising of Mṛga and the Bali-pratipada marked the beginning of the sidereal solar year. Also, it becomes apparent that the Vikrama Era is the remnant of the original sidereal calendar of 4137 BC devoid of its true astronomical rationale. Further the word 'dyūta' arose out of the root 'div' of Deva and the real meaning of the 'game of dice' is 'Kāla-gaṇana' or 'akṣahṛdayaṃ' and it is not just accidental that the terms 'Kali' 'Dvāpara' 'Tretā' 'Kṛta' etc., the terminology of the game appears in the mythological conception of the cycle of Yugas. In fact the cave no: 21 of Ellora depicts Śiva and Pārvati as playing the game of dice.

Naḷōpākhyānaṃ

Those who are skeptical of the above inference regarding the game of dice may look into the story of Naḷa at Mahābhārata, Vanaparva (Chapters:52-79). All the characters of this episode are astronomical like:

Puṣkara (related to water)	:	Summer solstice
Naḷa and Damayanti	:	Sun and Moon at Winter solstice
Kali and Dvāpara	:	Yuga sandhi
Kārkōṭaka sarpa	:	Āśleṣa nakṣatra of Karkaṭaka Rāśi
Ṛtuparṇa	:	Season winged year or Time

'Akṣahṛdayaṃ' that Naḷa learned from Ṛtuparṇa is nothing but astronomy underlying the calendar. Naḷa being Sūrya, he is depicted as an expert in 'Aśvahṛdayaṃ', which means the intricacies of solar motion. The word 'hr-da-yaṃ' implies an underlying mechanism of control and here it may mean a mechanism of the Akṣa and Aśva - of the earth's axis or of equator and of Aśva the sun.

The discovery of the Mūlādhāra Cakra and its epoch as well as the astronomical identity of the major characters like Rudra, Bhīṣma, Kṛṣṇa, Durga etc., has brought forth the true nature of the contents of the Purāṇas and the Epics. The solar and lunar dynasties and the episodes under narration in Mahābhārata and Rāmāyaṇa are all in fact descriptions of astronomical phenomena couched in allegory datable to an antiquity of 4000 BC or even deeper. The accurate description in the mythological language of the phenomena of 4137 BC point towards the existence of a well developed school of astronomy and Tantra in the remote antiquity. Decipherment of the details of ancient calendar astronomy from Purāṇic mythology is a delicate task and rests upon conjectures that can be substantiated only on the authority of the ancient Niruktas or the extensive Purāṇic and Vedic literature or by identifying the original astronomical rationales of some of the celebrations that have come down to us. The present author is ill equipped to make a detailed presentation on this aspect due to lack of sufficient knowledge in these areas.

5. Origin of Tithi

(a) Intricacy of Tithi

Sankar Balakrishna Dikshit has given the following account about the historicity and the astronomical import of the unit of time, which has come to be designated as 'tithi':

" Nowhere in the Vedic literature the author came across the word 'tithi' in the sense of the 30th part of the lunar month or the time required by the moon to gain 12^0 of longitude on the sun. Even though the month is lunar, its 30th part will be shorter than the civil day, because its length is about 29.5 civil days. Hence the mean length of tithi is shorter than a civil day and there is no easy and natural means to measure it, and on account of this we do not get in the Vedas either the true or mean tithi in its modern sense".

In the above quotation present author has added emphasis to highlight the complexity 'tithi' has as an astronomical unit of time. Dikshit has then quoted *Aitareyabrāhmaṇa* (32.10) to suggest the prevalence of a different kind of 'tithi', but the respective verse had a different interpretation by Keith as a corruption of Kauṣītakībrāhmaṇa (III.1), which rules out the possibility of an alternate definition for tithi. The Japanese scholar Yukio Ohashi has referred to this aspect briefly with the conclusion that – 'if Keith's interpretation is correct, the tithi is absent in Vedic Śrutis'. But Dikshit has spoken a bit more on the topic that has some relevance in the present discussion:

"In any case, the 'tithi' in the astronomical meaning and 'pratipad' and other tithis are found nowhere in the Vedas. But Pūrṇimā and Amāvāsya are denoted by the word " Pañcadaśi" meaning 15th.... Since the term Pañcadaśi has occurred in the sense of 'fifteenth', other terms such as Pratipad, Dvitīyā, etc., must have been in use to denote the first night, the second night etc. In the beginning, these must have been used to denote the nights and afterwards the tithis. The terms Kṛṣṇa caturdaśi, Kṛṣṇa pañcami, Śukḷa caturdasi, have occurred in the Sāma Vidhāna Brāhmaṇa (see 2,6; 2,8; 3,3)".

Dikshit has further quoted Taittirīyabrāhmaṇa and other Sūtras to illustrate the use of the term 'aṣṭaka' to designate the 8th night of the dark half. These instances clearly suggest the reckoning of lunar phases in a unit that counted 30 in number – whether these '30' were tithis or not is a question of interpretation. The fact that the use of the term 'tithi' is absent in the Vedic literature is not a sufficient justification for denying the existence of 'tithi' in the Vedic civilization. Vedas and Vedic literature cannot be expected to provide an exhaustive account of all the aspects of the civilization that produced it. 'Tithi' being a technical term had only very little chance to appear in the Vedic hymns and other associated literature. Normally, we can expect it to appear only in their treatise on astronomy and the term does appear in Vedāṅga Jyotiṣa in its astronomical form. But now we are beset with other doubts such as the date of the Vedāṅga Jyotiṣa and whether the use of tithi can be traced to a period anterior to the extant version of Vedāṅga Jyotiṣa etc.

Tithi In The Vedas

Even though we are unable to locate a direct reference to the unit of 'tithi' in the Vedas, an important indirect reference is available in the Ṛgveda (III.9.9) where Ṛṣi Viśvāmitra refers to the 3339 dyus worshipping Agni. According to Vedāṅga Jyotiṣa each tithi consists of 9 bhāmśas and thus 3339 (=371 X 9) may obviously mean the 371 tithis of a year. Same idea can be found in Taittirīya saṃhitā VII.2.6.1, which speaks of the 11days that exceed the 12 lunar months, in a year.

Tithi In Babylon

Tithi's significance as an astronomical unit can be understood from the fact that O.Neugebauer had to make use of it in deciphering the astronomical tablets recovered in Mesopotamia. O. Neugebauer says:

"A modul of 30 days in a lunar calendar would rapidly accumulate an intolerable error. Hence "30" must represent a mean lunar month, whatever its length may be in ordinary days. This fact leads to an important new concept. We introduce schematic months of constant length (hence called "mean lunar months"), which we divide into 30 parts, also of equal length. We call such a part (with a Sanskrit term) "tithi" ..."

Vedāṅga Jyotiṣa belongs to the antiquity of 2423 BC as against the Babylonian records of 3rd or 4th century BC and hence the concept of tithi had its origin in ancient India. The two important characteristics of Babylonian astronomy as noted by O. Neugebauer viz., the use of arithmetical methods and the synodic arcs (elongation from sun) in fact formed the basis of the pre-siddhāntic Indian astronomy also as is evident from the Pañcasiddhāntikā. The arithmetical solstice pattern that we see in the Uruk scheme of Babylon and the 19-year cycle are derived from the arithmetical methods of Vedāṅga Jyotiṣa as interpreted by P.V.Holay.

As is evident from the above quoted opinion of Dikshit '*tithi*' is an odd unit difficult to conceive and measure in the normal course. How could such a unit evolve in the pre-historic antiquity of Ṛgveda? O.Neugebauer has speculated on the origin of the practice as follows:

"It remains to be noted that the concept of "tithi" as unit of time is by no means restricted to the computation of solstices. It will be encountered again in the planetary theory and in the lunar theory itself. The same units play an important role in Indian astronomy to the present day... The practical advantage of introducing such a unit is evident from its use discussed so far. Since calendaric lunar months are either 29 or 30 days long a tithi will be nearly the same as an ordinary day. Hence if we ignore fractions and call the integer parts of the tithis simply "days" within a lunar month we will always keep near to the corresponding calendar dates, but avoid the determination for each month of its actual length. In other words the tithis help to eliminate the painful consequences of a strictly lunar calendar".

In the light of Neugebauer's earlier words that a *modul of 30 days in a lunar calendar would rapidly accumulate an intolerable error* the above abstract speculation – 'if we ignore fractions and call the integer parts of *tithis* simply days' - appears incomprehensible. How can anybody assess the integer parts of *tithis*, when tithi itself is a unit difficult to measure? Measurement of the duration of a tithi can only add more pains to a lunar calendar rather than eliminating the pains? Any day count (or even night count as suggested by Dikshit), as noted by Neugebauer, shall result in an intolerable error and there was no practical method to visualize a lunation of 29.531 days in terms of 30 units. Astronomy had its origin in observations and hence the unit of tithi most likely had an observational origin rather than a conceptual or theoretical development as suggested by O. Neugebauer.

Observational or Phenomenal Origin of Tithi

We see in both Vedāṅga Jyotiṣa as well as Babylonian astronomy the use of *tithis* or elongation of moon relative to sun in charting the solstice dates. Such a practice point towards the possibility that at some epoch in the past the solstices probably had an

explicit identity in terms of the lunar phases such as Amāvāsya, Pūrṇimā, or the Aṣṭaka, which could have been ascertained without any confusion. In fact we can find allusions of such an epoch in the Vedic literature. Kauṣitakībrāhmaṇa XIX.3 refers to the coincidence of winter solstice with the new moon of Māgha. Prof. P.C.Sengupta has quoted the following five instances from the Vedic literature, which is relevant in our discussion. The sun turned north on the:

(a) New moon of Māgha ended.

(b) Last quarter of Māgha

(c) Full moon of Māgha

(d) One day before full moon of Māgha

(e) New moon of Māgha begun.

First of the above, the winter solstice coinciding with the new moon of Māgha-end can be met with quite ideally in 4137 BC when the summer solstice was also coincident with new moon. The data relevant to the present discussion are:

Summer solstice: 25th July 4137 BC, UT 22:48, JD 210590.45;
Sun=90^0, Moon $85^049'$: New moon)

Winter solstice: 20th January 4136BC,UT 04:56, JD 210768.70;
Sun 270^0, Moon $278^049'$: Śukḷa pratipada

Further, astronomically the duration of the seasons since 4000BC are as follows at an interval of 1000 years:

Year	Spring	Summer	Autumn	Winter
-4000	93.54	89.18	89.08	93.43
-3000	94.04	89.92	88.62	92.67
-2000	94.28	90.76	88.40	91.81
-1000	94.25	91.63	88.42	90.94
0 AD	93.96	92.45	88.70	90.14
1000	93.44	93.15	89.18	89.47

The above data illustrate the possible disparity between the two halves of an year viz., sum of spring & summer / autumn & winter constituting the half years from equinox to equinox while summer & autumn / winter & spring making up the solstice to solstice divisions. The half-years mentioned above, with reference to either of the cardinal points shall assume a minimum / maximum value when the perihelion /aphelion coincide with either of the cardinal points. The perihelion in fact coincided with the autumnal equinox in

the year 4079 BC (JD = 231346 correspond to a perihelion longitude of 180^0) to produce the maximum disparity between the lengths of the two half-years considered with reference to the solstices. Minimum and maximum duration can be understood from the following data of seasons for 4000BC:

Year	Spring Equinox	Summer Solstice	Autumnal Equinox	Winter Solstice
4000 BC	22 April	25 July	22 October	19 January
JD	260535.365	260628.89	260718.038	260807.14

Minimum value of the half-year = 178.25 days
Maximum value of the half-year = 365.25 - 178.25 = 187 days

In view of the above asymmetry the half year from summer solstice to winter solstice i.e., solar transit over 180^0 came to be looked upon as consisting nearly of 6 lunation = 177days(180^0 relative to sun) while on the other side occurred a surplus of 11 days roughly (188-177=11 days). In 188 days of the latter half moon would have transited through 6.366 revolutions (= 191tithis relative to sun) and would have thus formed the 371 (180 + 191=371) tithis i.e. synodic arcs of 12^0 each. In other words, when the year got split into two halves of 6 and 6.36 lunation, 11 surplus days could be experienced in the latter half and this phenomenon led to the notion of tithis by the following arithmetic:

Solar arc = 180^0; Corresponding Moon's arc = 360^0x6 =2160^0 No. Of tithis = 2160/12=180. In the latter half this will be (360x 6.366 / 12) equal to 2291.76/12 = 191 tithis. It will be interesting to note that the mean speed of moon in the former half, 6 lunation divided by 180^0 (177/180=0.9833) in fact equals the odd unit of tithi (less than a civil day) and 0.98333 X 371 = 365 days of an year.

Discovery of 19-Year Cycle and Solar Anomaly

The above epoch facilitated an easy discovery of the 19-Year cycle of lunation in view of the coincidence of solstices and new moon at intervals of 19 years. Further the moon's additional revolutions of the latter half and the extra number of days (While the solar month was equal to the lunar month in one half there was a noticeable disparity in the other if the 188 days were treated as 6 solar months of 32 days each in a sidereal solar year) pointed towards the asymmetry in the speed of sun and the apex of slow motion, the star λ-Orionis got designated as " Mārgaśīrṣa" or 'Orbital vertex'. (Or perhaps the solar month of Dhanu itself got designated as Mārgaśīrṣa to mean the phase of solar fast motion). The term lost its real meaning in due course and became Mṛgaśīrṣa just as it happened in the case of 'Sapta-rkṣa' or "Seven shining ones " who became subsequently the 'seven Bears' and 'seven Ṛṣis'.

The dominant influence we see of 'aṣṭaka' (last quarter – Kṛṣṇa 8) in the Vedic literature in fact point towards sidereal intercalations involving 40 years.

Evidence of 'Indra-Dhvaja'

Apart from the astronomical features outlined, certain Vedic customs also renders support to the notions presented above. H.Jacobi has suggested the existence of three different year-beginnings respectively from the summer solstice, autumnal equinox and the winter solstice in Vedic times. The epoch of 4137 BC is reflective of such year beginnings in view of the coincidence of new moon with the aforementioned cardinal points. When the year had its beginning from the winter solstice, the succeeding summer solstice came on Bhādrapada śukla 12 in view of the asymmetry in the two halves of the year i.e., due to the extra 11 days of the half year from winter solstice to summer solstice. As such on the summer solstice day the moon occupied the constellation Śrāvaṇa and this particular occasion came to be celebrated by hoisting the 'Indra-Dhvaja'[Ψ]. Prof. P.C. Sengupta has referred to this legend in detail and has taken 'Indra' to mean the god of summer solstice responsible for the rains. Hoisting of the flag marked the victory over Asuras – an allegorical reference to the diametrically opposite point of winter solstice and the respective year beginning that marked the midnight over South Pole.

Ekaviṃśa day

Another piece of evidence can be found in the Aitareyabrāhmaṇa Ch XVIII.18, which says that 'by this ekaviṃśa, the gods raised up the sun towards the highest point of the heavens'. In explanation Sengupta adds that 'they called the 11th day or the middle day of this period, the Ekaviṃśa or the true summer solstice day'. The twenty-one days in which sun remained stationery i.e., the ten days on either side of the solstice and the true solstice as the 11th day most likely had its origin at the above epochal year beginning of 4136 BC and the subsequent summer solstice.

Mahāśivarātri

The 14th day of the dark half of Māgha (Māgha kṛṣṇa caturdaśi) is observed as Śivarātrivṛta and the devotees are supposed to remain awake all through the night. Ṛgjyotiṣa 34 suggests the astronomical rationale with which the observance would have been initially conceived. According to Ṛgjyotiṣa the sunrise at the end of 29th tithi of Pauṣa had to be observed to ascertain the stellar occupation of sun and to begin the 19-year Yuga. On a similar rationale the Śivarātrivṛta must have come in force at a time when the year and Yuga had to begin with the Phālguna or the solar month of Pisces as can be seen at the epoch of 4136 BC. In other words, the Mahā Śivarātrivṛta is a pointer to the fact that the ancient past had a Yuga and year beginning with the light half of Phālguna coinciding with winter solstice and the Ṛgjyotiṣa as well as the 19-year cycle along with the tithis had prevalence in those ancient days.

As is well known the discipline of astronomy had its origin in the observations of the sky by the ancient civilizations. To use a little of figurative language it was the sun and moon

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Ψ As an example of the epoch: If the year began with the winter solstice on 20th January 4136 BC (JD=210768.71), the summer solstice will be on 26 July 4136 BC at 1340 IST (JD= 210955.84) and on the night the moon will be in conjunction with Śrāvaṇa or Altair. (Moon's longitude at 1340 IST was $213^0 20'$ and so at 2200 hrs in the night it will have a longitudinal conjunction with Altair. Also moon had southern latitude of more than 4^0 on the above date.)

who taught men the science of keeping a calendar and various concepts emerged inspired by different phenomena that presented those specific concepts in a noticeable or captivating manner. The various units of time day, night, month, year, 19-year cycle etc., all emerged in the same way. The evolution of 'Tithi', which is a very ancient unit of time can be no different. There must be some specific epoch and phenomenon that enabled men to conceive this odd unit of time. The asymmetry in the two solar halves of the year - summer to winter solstice and winter to summer solstice - relative to lunar motion (arc covered by moon in the two halves were noticeably different) around the period of 4136 BC is illustrative of the origin of tithi as a unit of reckoning time.

6. Sidereal Zodiac – An Astronomical Phenomenon

The rudiments of a division of the ecliptic in to 27 stellar divisions of $13^0 20'$ each can be found in the Vedic literature. Ṛṣis concieved the Kālapuruṣa or the Cosmic Man of Time based on the principle of symbolic equivalence of the macrocosm and microcosm, which was fundamental to the philosophy of the Vedic as well as Tāntric cults. In accordance with the above principle, the Tāntric conception of Mūlādhāraṃ can be explained as having an astronomical rationale and the sidereal zodiac appears to be a mathematical abstraction of the ecliptic using the epochal equinoxes and solstices as well as the fiducial star Mūla (λ-Scorpii) In this sidereal construction Mūla marked the bottom of the cerebro-spinal axis of Kālapuruṣa as well as the beginning of the respective nakṣatra division. Considered from "Aśvinyādi" Mūla marked the end-point of the 18th nakṣatra division at 240^0. As we saw earlier in the discussion Mūla as such had been of cardinal importance to the ancient Indian Calendars.

Autumnal Equinox Over Mūla in the Vedic Tradition

H. Jacobi had suggested as early as in 1894 that the Vedic hymns point towards three different "Year-beginnings" viz.,

(1) 'Varṣa' or 'abda' – the terms representing the year, suggested beginning of the year with the rainy season in the month of Bhādrapada vis-à-vis summer solstice.

(2) Śarad year reckoned from the autumnal equinox and the month of Mārgaśīrṣa (Āgrahāyaṇa)

(3) Hima year starting with the winter solstice in the month of Phālguna.

B. G. Tilak on the other hand suggested 'Year beginnings' with:

(1) The Vernal equinox marked by the acronycal rising of Mūla
(2) Winter solstice on Bhādrapada and
(3) Pitṛyāna beginning with the autumnal equinox.

Above analysis by the reputed scholars differ in terms of detail but invariably suggest a calendar epoch few centuries earlier to 4000 BC.Veracity of the pictures they have drawn

can be established only if we are able to precisely determine the epoch under reference. Studies into Vedic antiquity has shown that the Vedic people were cute observers of the sky even though they may not were in possession of instruments. As such it is quite possible that certain astronomical phenomena might have been the guiding factor in the choice of their different year beginnings and the respective initial epoch.

Epoch As Conceived by H. Jacobi

The epoch described by Jacobi is the same as that we obtained from the analysis of the iconography of Śiva. Relevant astronomical features are:

Date	JD	Sun and Moon	Remarks
(-) 4136 July 25 UT: 22:48:17	210590.4502	Sun: 90^{0} Moon: $85^{0}49'$	S.Solstice and New moon
(-) 4136 October 23 UT: 01:14:35	210679.5518	Sun: 180^{0} Moon: $177^{0}26'$	A.Equinox and New moon
(-) 4135 January 20 UT: 04:56:25	210768.7058	Sun: 270^{0} Moon: $278^{0}49'$	W.Solstice and Śukḷa (1)

A similar configuration of new moon / Śukḷa (1), prevailed before and after this epoch with the periodicity of 19 years for centuries, but the new moon and autumnal equinox fell over Mūla i.e. Mūla precisely marked the midpoint of the 'phenomenal arc' only in 4137 BC. These computational results provide a complete substantiation of Jacobi's views about the early epoch of Indian astronomy.

Pattern of Intercalation

In the course of centuries of its development ancient Indian astronomy might have taken recourse to different patterns of intercalation for making the 'Year-beginning' to be in step with the seasonal cycle (tropical phenomena of the cardinal points) or a precise fixed sidereal location independent of the seasonal phenomena. It is apparent from the above epoch of 4137 BC that the ancient astronomers through their naked eye observations of the solstices could have very easily discovered the 19-year cycle of 235 lunations as the new moons successively coincided with the solstices with the periodicity of 19 years over many centuries. Apart from the 19-year lunation-cycle, which follows the cardinal phenomena, certain authors have pointed towards the possibility of sidereal intercalation after a period of 40 years by making use of the periodicity in the relative positions of Sun, Venus and stars. If we include moon also in the above picture it can be found that the lunar qudratures also could have been of guidance for intercalation with respect to the sidereal solar year as shown below:

No. of Years	Number of Lunations	Tithi for Intercalation
40	494.75	Kṛṣṇa (8)
80	989.5	Śukḷa (15)
120	1484.25	Śukḷa (8)
160	1979	Full cycle

Or,

No. of Years	Number of Lunations	Tithi for Intercalation
120	1484.25	Śukḷa (8)
240	2968.5	Śukḷa (15)
360	4452.75	Kṛṣṇa(8)
480	5937	Full cycles
1200	14842.5	Śukḷa (15)
2400	29685	Full cycles
4800	59370	Full cycles
6080	75202	Full cycles

It can be shown by modern astronomical computations that the above table fits in very well with the actual luni-solar phenomena. Towards this end a sidereal zodiac is defined for the epoch of 4137 BC with the following features:

Fiducial star: Mūla of sidereal longitude 240^0 from "Aśvinyādi".

Ayanāṃśa (-4136): 60^0

New moon / Śukḷa pratipada marked the Sūrya-saṃkramaṃ (solar transit) into the zodiacal signs of 30^0 s at 4137 BC and 1944 AD with the details given below:

Zodiacal Signs (Sidereal)	JD for solar transit 4137 BC	Tithi (Moon-Sun)/12	Solar transit JD After 6080* sidereal years. 1944 AD
Kanyā (Virgo) $150^0 - 180^0$	210590.4502	29.65: New moon	2431350.3444
Thulā (Libra) 180^0 -210^0	210620.56761	0.062: (Śukḷa -1)	2431380.809

Vṛścika (Scorpio) 210^0 –240^0	210650.1965	0.044: (Śukḷa -1)	2431410.806
Dhanu (Sagittarius) 240^0 –270^0	210679.5518	29.79: New moon	2431440.397
Makara (Capricorn) 270^0 -300^0	210708.914	29.59: New moon	2431469.844
Kumbha (Aquarius) 300^0 –330^0	210738.5612	29.82: New moon	2431499.35
Mīna (Pisces) 330^0 –360^0	210768.70573	0.736: (Śukḷa -1)	2431529.266

*6080 = 38 periods of 160 sidereal years having 1979 lunations

As against this remarkable periodicity of the lunar phase with the period of 160 sidereal years and its multiples over the sidereal zodiac (i.e. with respect to stellar positions), the 19-year luni-solar cycle of 235 lunations has failed to be in tune with the solstices with the passage of time. 6080 years up to 1944 AD brought in a difference of about 4 tithis between the summer solstice and the new moon. Further, it is interesting to note that the periodicity of the lunar phases over the sidereal fixed zodiac is centered around the star Mūla (λ-Scorpii) which is located very near the galactic center SgrA*. The location of solar perigee also might have played a role in this periodicity.

Origin of the Yugas

As can be gleaned from the Vedāṅga Jyotiṣa the concept of a Yuga had its origin in the 19-year cycle of lunations. Obviously the next step would have been a development based on the 40-year cycles wherein the tithis Kṛṣṇa (8), Śukḷa (15), Śukḷa (8) and new moon must have served as the basis of intercalation. With the passage of time bigger cycles were probably conceived to bring in a natural order of tithis i.e. new moon, Śukḷa (8), Pourṇamī, Kṛṣṇa (8) and new moon in the intercalation process. i.e., cycles of 120, 240, 360 and 480 years. It is apparent that the Yuga cycle of 1200,2400, 3600 and 4800 *years arose out of the above sidereal intercalation process. Many of the Hindu* celebrations such as Kalpādi, Manvādi, Yugādi etc., probably derived their astronomical rationale from the epochs at which intercalation was accomplished.

Commencement of the months and nomenclature

Both the pūrṇimānta (ending with full moon) and amānta (ending with new moon) systems were prevalent in ancient India. It can be understood from the above discussion that the pūrṇimānta and amānta systems did in fact alternated with an interval of 80 years over the sidereal zodiac. But it is apparent that the amānta tradition preceded the pūrṇimānta tradition and hence the solar months had their nomenclature on the basis of the nakṣatra of full moon (Please note that from Kanyā to Mīna the full moon was at the middle of the solar month and thus ideally served as an identity for the month). As can be found in the Ṛgveda (X.85.2), in 4137 BC, Moon was really the marker of months and years. From summer solstice to winter Solstice the duration was only 178.255 days and hence each solar month of the half-year beginning with Bhādrapada was very nearly

equal to the length of a lunation. On the contrary, over the latter half the solar months were longer and this observation probably led the early astronomers in to the discovery of solar anomaly.

7. Vedāṅga Jyotiṣa and 19-Year Cycle

Ṛk Jyotiṣa has remained a set of obscure verses in its known history till the arrival of P. V. Holay on the scene. With very little emendations Holay has brought out the rationale of the verses with clarity by assuming a Yuga of 19-years in the following sequence:

Serial No.	Name of the year	Tithi at S.Solstice	Tithi at W.solstice
1.	Saṃvatsara	Śukḷa (7)	S (1)
2.	Anuvatsara	Kṛṣṇa (3)	S (12)
3.	Idvatsara	K (14)	K (8)
4.	Saṃvatsara	S (10)	S (4)
5.	Parivatsara	K (6)	S (15)
6.	Idaavatsara	S (2)	K (11)
7.	Saṃvatsara	S (13)	S (7)
8.	Parivatsara	K (9)	K (3)
9.	Idaavatsara	S (5)	K (14)
10.	Anuvatsara	K (1)	S (10)
11.	Idvatsara	K (12)	K (6)
12.	Saṃvatsara	S (8)	S (2)
13.	Idaavatsara	K (4)	S (13)
14.	Idvatsara	K (15)	K (9)
15.	Saṃvatsara	S (11)	S (5)
16.	Parivatsara	K (7)	K (1)
17.	Idaavatsara	S (3)	K (12)
18.	Anuvatsara	S (14)	S (8)
19.	Idvatsara	K (10)	K (4)

S = Śukḷapakṣa, K = Kṛṣṇapakṣa.

It is apparent that the years were classified into five types according to the initial tithi at winter solstice as per the rule:

Tithi of Year beginning at Winter solstice	Name of the Year
S (1) to 5 (6)	Saṃvatsara
S (7) to S (12)	Anuvatsara
S (13) to K (3)	Parivatsara
K (4) to K (9)	Idvatsara
K (10) to K (15)	Idaavatsara

Only Holay could discern the deeper significance of the opening verse of Ṛk-jyotiṣa viz., "Pañca saṃvatsaramayaṃ yugādhyakṣaṃ Prajāpatiṃ" i.e., Yuga is constituted of five Saṃvatsaras and this is possible only with the 19-year cycle. Had the term 'saṃvatsara' had only the simple connotation of an ordinary year there was no need for the use of "Pañcasaṃvatsaramayaṃ" instead of "Pañcasaṃvatsara yuga". Use of Saṃvastara in the opening verse has a technical sense and Holay rightly interpreted the verse to discover the truth.

Similar to the above Holay also creatively interpreted verse 14 which lists the nakṣatras in the sequence "Jau, Drā, Gha ..." as the basis of classification of the years according to nakṣatras. He has given a mutually consistent / harmonious interpretation of the different verses that defied the wisdom of great scholars such as S. B. Dikshit, T. S. Kuppaṇṇa Śāstri etc. Holay's work leaves no room for any suspicion or controversy on the interpretation he has given by adapting the 19-year Yuga cycle. Unfortunately historians of Science and other academicians have not given proper recognition to this meritorious work and so it remains unpopular even today. The book was first published in English in 1989 and we had enough time to expose the weaknesses if any of Holay's interpretation.

The pattern of tithis derived earlier for summer solstice can be found dicto on page 361, History of Astronomy by O. Neugebauer as forming the Uruk scheme of calendar. Remarks of O. Neugebauer with reference to the same are noteworthy:

"While the investigation of the Uruk scheme leaves no doubt about its equivalence with the 19-year cycle, the historical question of its time of origin remains almost completely in the dark. It seems plausible to consider the strict Uruk scheme as of some later origin than the 19-year cycle. But we know so little about the chronology of the cycle itself that it is impossible to derive from it conclusions about the invention of the detailed solstice-equinox pattern"

Holay's interpretation of the Ṛk-jyotiṣa in fact lays down before us the "detailed solstice-equinox pattern" that O. Neugebauer has discovered among the clay tablets of Uruk. Placed against the above background, Ṛk-jyotiṣa as interpreted by Holay has the potential to inspire a wholesome revision of the history of astronomy as produced by O. Neugebauer on the strength of Babylonian clay tablets.

8. Astronomical and Historical Evidences

A number of well established astronomical and historical facts point towards a well developed school of astronomy in prehistoric India.

(a) Siddhāntic astronomy had the mean obliquity of earth's axis as 24^0 and this could have been true only around 3000 BC. Mean obliquity was $24^0 07'$ in 4137 BC and $24^0 02'$ in 3102 BC. It is therefore likely that the siddhāntic value had its origin in 4137 BC or even earlier.

(b) The greatest equation of center for the sun as per Sūryasiddhānta is 2^0 10' 32" and this would have been true only around 3500 BC.

(c) The existence of Śrīyantra in the Tāntric tradition speaks eloquently of the great heights the ancient cult had in mathematics, astronomy and yoga. In fact without yoga and Mūlādhāra Cakra the Śrīyantra makes no sense in the Tāntric philosophy.

(d) The manuscript of 'Aṃśu Bōdhini', which describe the spectrometer of Maharṣi Bharadvāja also point towards the development of science in prehistoric times. In fact this work of Bharadvāja poses a great challenge to the wisdom of historians who have termed Indian antiquity as primitive.

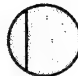
(e) Prof. P. C. Sengupta has quoted Sūryasiddhānta (II. 1-5) as indicative of the existence of pre-epicyclic astronomy in ancient India.

(f) Babylonian fixed zodiac is the Mūlādhāra Cakra. The tradition of a sidereal solar calendar as well as the worship of Phallus and the Serpent are deep rooted in Kerala which had trade connections with Mesopotamia. In fact the Jyotiḥśāstra tradition and the Serpent worship of Kerala are so well entrenched that they have no parallel elsewhere in the world. The Serpent (Nāgaraja) temples as well as the temples of Harihara-putra & Kanyākumāri must have beneath them a hitherto unknown history of astronomy as well as civilization.

(g) "Ophiolatreia" an Egyptian historical treatise of anonymous authorship declares the Serpent as the Creator of the Universe. Horus the Lord of Time is also referred to as a snake i.e. in Sanskrit terminology nothing but 'Kāla-sarpa' or 'Rāhu-Śikhi Cakra'. The confusion prevailing as regards the rationale behind these practices of Phallus & Serpent worship can be understood from the following paragraph of "Ophiolatreia":

"The worship of the Serpent, next to the adoration of the Phallus, is one of the most remarkable, and at first sight, unaccountable forms of religion the world has ever known. Until the true source from whence it sprang can be reached and understood, its nature will remain as mysterious as its universality, for what man could see in an object so repulsive and forbidding in its habits as this reptile to render worship to, is one of the most difficult problems to find a solution to. There is hardly a country of the ancient world, however, where it cannot be traced pervading every known system of mythology"

(h) Universality of the divisions of the ecliptic, zodiacal signs, Gnomon, number and names of the week-days, similarities in the nomenclature of the constellations and mythology etc., and universality of the equivalence of microcosm and macrocosm, worship of Time, Sex and Snake all point towards a common origin of astronomy and astrology. With the above discovery of the Mūlādhāra Cakra no place other then India can have a better claim as its land of origin.



VII

MYSTERY OF TIME, DESTINY AND TANTRA

"The achievement of human destiny cannot be left to be worked out by the blind and wasteful evolutionary processes of nature. Nature has taken half a billion years to achieve our present state; at this rate evolution will take a few more billion years to evolve the perfect man, the fulfilled man. We shall have to wait, in the language of Tennyson, for that '...far off divine event to which the whole creation moves'.

Shall we, then, wait that long? Or shall we achieve it now? Shall we just float with the current of nature and achieve fulfillment as and when nature achieves it for us? Or shall we take our destiny from the hands of nature into our own and achieve it here and now?"

Julian Huxely* tells us that man, with his intelligence and imagination, has the capacity to direct his evolution and quicken its pace in himself and in his environment.

"It is only through possessing a mind that he has become the dominant portion of this planet and the agent responsible for its future evolution; and it will be only by the right use of that mind that he will be able to exercise that responsibility rightly. He could all too readily be a failure in the job; he will succeed only if he faces it consciously and if he uses all his mental resources – of knowledge and reason, of imagination, sensitivity and moral effort". **

*Julian Huxely, Issues in Evolution, Volume III of Evolution after Darwin, p.252

** Passage quoted from Svāmi Raṅganāthānanda's work: 'The Message of the Upaniṣads'.

"Nature is not cruel, only pitilessly indifferent. This lesson is one of the hardest for human to learn. We cannot accept that things might be neither good nor evil, neither cruel nor kind but simply callous: indifferent to all suffering, lacking all purpose.

We humans have purposes on the brain. We find it difficult to look at anything without wondering what it is "for", what the motive for it or the purpose behind it might be. The desire to see purpose everywhere is a natural one in an animal whose waking thoughts are dominated by its own goals and aims.

The true process that has endowed wings, eyes, beaks, nesting instincts and everything else about life with the strong illusion of purposeful design is now well understood: It is Darwinian natural selection".

Richard Dawkins

[Biologist, Oxford University]

VII

MYSTERY OF TIME, DESTINY AND TANTRA

1. Mystery of Time

Time, everyone knows – all are familiar with the day, week, month, year and other such modes of reckoning and its regenerative and degenerative impact over the world. Apparently time is a flow incessant, eternal, and enigmatic beyond the comprehension of anyone. The great mystery of time[Ψ] finds an admirable expression in the words of St. Augustine:

"What then is time? I know well enough what it is, provided that nobody asks me; but if I'm asked what it is and try to explain I am baffled. All the same I can confidently say that, I know that if nothing is passed, there would be no past time; if nothing were going to happen there would be no future time; and if nothing were there could be no present time."

Historically speaking Time had been a matter of concern even to the so-called primitive people in its two important aspects of duration and location or 'interval' and 'epoch'. The most popular year count of humanity, the Christian era had its beginning only 2000 years before the present. Records of the Maya civilization place their earliest known epoch and the most recent moment or epoch of creation at 3114 BC i.e.5114 years before the present. Archbishop Ussher and John Lightfoot have precisely determined the creation of the biblical world as have taken place on 26th October 4004 BCE 0900 hours at Mesopotamia. Legendary conceptions of the Hindus speak of time as constituted by innumerable cycles, the last of which had its creation completed at 1955883102 BCE and the present phase of humanity designated as 'Kali' began on the midnight of Thursday, 17th February 3102 BC, at Ujjain.

Modern scientific age had its beginning with a conception of historical time woven around the 17th century calculation of Bishop Ussher that the world was only 5650 years old. Naturalists and philosophers of the 18th century came into conflict with this belief and they pushed back time into great depths of reckoning. In 1749, French naturalist Comte de

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[Ψ] On a metaphysical level the beginning of time and universe had been under deliberation even in the great antiquity of the Vedas. We can find in the Taittirīyabrāhmaṇa II.9.6:

"*Who really knows whence and how this Universe was created? Or who can tell it? Even the gods were born later; who knows Him from whom the world was created? Who knows the 'tree' from which the heaven and the earth were created and in what forest was it growing? It is only He, the controller of all these things, who dwells in the 'supreme ether', who knows this. Perhaps no one knows if even He knows this or not.*"

(SB Dikshit)

Buffon reckoned the age of earth as between 70,000 – 50,000 years while in 1755 Immanuel Kant extended Cosmogony to hundreds of millions of years. Being dissatisfied with the legends of a dateless past, modern science has since then found many clues to reach up to the great antiquities. Today scientists can trace civilizations back through thousands of years, mankind through hundreds of thousands, life through millions and universe through billions of years. Now at the close of the present millennium we reckon the age of the earth to be about 4.6 billion years rather than the 6000 years of the Bible. While the astronomers and the geologists were charting out time in billions of years at one end of the spectrum, the physicists were subdividing it at the other end to reach the billionth of a second!

- Have all these achievements contributed towards a better grasp of time?
- What remains to be known, when we could divide the 'twinkling of an eye' to its billionth part?

We have studied the world with reference to time intervals big and small, but we are yet to gain an understanding of its role in the evolutionary process. It is here the intricacy of time begins – it is as eternal as evolution or may be it's evolution itself – but how does it manifest and what are its implications for a human life? Modern world-view having the dominance of materialistic doctrines tend to depict the temporal descent of Man in terms of an assemblage of natural processes consistent with the laws of physics which were neither foreordained nor programmed. But this leaves many questions unanswered such as wherefrom the process gains direction and what is the ultimate conclusion? The theory of evolution had its beginning with the Lamarckian hypothesis of an in-built drive towards perfection in organisms which got subsequently replaced by Darwin's hypothesis of natural selection. Production of variation and selection through 'survival of the fittest' finally became the crux of the theory evolution with the advent of genetics. But the concept of natural selection does not entirely rule out the possibility of a drive towards perfection - say, for example, superimposed over the evolutionary arrow of time - instead of being in-built in organisms – that ultimately paved the way for Man's godly descent upon earth. Whether Man is a perfect creation or not is of course debatable but undoubtedly His advent marks a critical point or threshold in the long drawn evolutionary chain. In the words of Ācārya Rajanīsh:

"Evolution like time never comes to a halt...both is eternal. Man is an evolving being in existence...a seed, the seed of God; if the seed remains a seed it will be in anguish being unable to realize the joys of growing and blooming, the fulfillment that a tree is having. Nature has brought Man to a threshold, having a potential to accomplish the enlightenment – to become the likes of Krishna, Buddha and Jesus. An urge to be so is what distinguishes a man from the animal out of which he evolved".

Modern science may not well agree with this what may be described as a metaphysical assessment of Man's position in comparison to other living beings. An unfortunate irony of modern times is that Man calls himself as 'modern' and but still believes him to be one among the 'very old' species of animals belonging to the preceding stages of evolution. He has not realized the 'modern' element nature has imbibed in him and obviously therefore he has developed a strange relationship with nature that nurtures his animal instincts rather than his godly descent upon earth. Technological development of the last few hundred years have taken Man even beyond the limits of earth, but he has allowed

himself to be enslaved by the technology he has produced in much the same way as nature became a victim at the hands of its own creation, Man. The implements he has created for his senses to communicate with the outer world, in as such is not a novelty being visible of course to a lesser degree in many species that preceded him. What then is the uniqueness of Man standing atop the pyramid of evolution? Like any other animal he also lives, procreates and dies, leaving no trace of him – In what way has he distinguished himself from the other creatures? A convincing answer to this question is available only in metaphysics.

2. Uniqueness of Man

What really is the distinguishing characteristic that places Man at the top of the evolutionary chain?

Asat or the un-manifested had the will to evolve implicit in it and thus time had its hypothetical beginning for the present world in the Big Bang. *In the vast in*-comprehensible expanse of the evolutionary time, at some point the biological line sprouted out to produce the living beings with Man atop.... While the pre-human stages of life were all subservient to nature Man had a will born in himself to extricate out of the silent frame of nature and to start questioning the sensory world over an array of windows such as - why – what – how and when? Ultimately, he searched for a meaning for his own transient existence and we can find a reflection of this history of evolution in the following prayer of the Brhadāraṇyakopaniṣad.

Asato mā sat gamaya	(lead me from the un-manifested to the manifested)
Tamaso mā jyotir gamaya	(...from darkness of ignorance to enlightenment)
Mrtyor mā amrtaṃ gamaya	(...from death to immortality)

Inquisitiveness, a yearning for enlightenment is the hallmark of human descent. Upaniṣads have described this quality as 'Brahmajijṅāsa', owing to which the mystery of the Universe captivates the mind and triggers up the intellect to ponder...!

There was no such distinction between physics and metaphysics as it exists today in ancient times and the existential questions were all a part of Man's quest for enlightenment. The depths of the ancient deliberations can be understood from the following passages available in Śvetāśvataropaniṣad (I.1-3):

1. Hariḥ Ōṃ! Brahmavādino vadanti: Kiṃ kāraṇaṃ-Brahmaḥ? Kutaḥ sma jataḥ? Jeevāma kena, kva ca saṃpratiṣṭha? Adhiṣtitaḥ kena suvetareṣu vartāmahe Brahmavido vyavastaṃ.

The philosophers are on deliberation as to: What is the primal cause-Brahma? Whereof have we born? Of what we are being sustained? Where shall be the ultimate refuge? O' philosopher, on what is it the sorrow and happiness are vested and who may be the regulator?

2. Kālasvabhāvo niyatir yadṛcha, bhūtāni yoniḥ puruṣa iti cintya

Samyōga eshāṃ na tvatmabhavadatmapyatisah sukhadukhaheto

Time, inherent nature, destiny, chance, the five elements, the spirit – neither of these can be concluded as the cause of this phenomenal world. All these are subservient to the soul and inactive to be the cause...Even the soul has no freedom to be the dispenser of joys and sorrows.

3. Te dhyanayoganugata apasyan devatmasaktiṃ svaguṇairnnigūḍhaṃ

Yaḥ kāraṇāni nikhilānitāni kālātmayuktānyatiṣṭhatyekaḥ

By meditation they have found out the divine power resting within the soul, veiled by the gunas – the only foundation of the different causes discussed... including Time and Soul.

4. Tamekanemiṃ trivṛtaṃ ṣōḍhaśāntaṃ, śatārdhāraṃ viṃśati pratyārabhiḥ

Aṣṭakaiḥ ṣaḍbhir viśvarūpaikapāśaṃ, trimārgabhedaṃ dvinimittaikamōhaṃ

This world resembles a wheel of different gradations 50, 20, 16, and 48 encircled by the satva-rajas-tamo guṇas, attached to the three pathways of Dharma, Adharma and Jñāna with the rope of Puṇya and Pāpa and Mōha is its rotation.

Sages of the ancient past had a devoted occupation with the mysteries posed by life and time and the wisdom or enlightenment they have received got paraphrased in the symbolic language that we see in the Tantras, Vedas as well as Upaniṣads. In contrast to the above spirit of metaphysical inquiries, modern science with its focus on the present aims to have a working hypothesis that renders an explanation for the phenomenal universe the limits of which obviously lie in our five senses. It is our senses that illuminate the world and all our theories are nothing but a caricature drawn of the sensory impressions. It has nothing to do with the reality or the truth of the world. As for example just imagine as to what would have been the picture of the world in the minds of a species having no eyes at all? Or, what would have been our own impressions of this world in case of a prismatic lens in our eyes? Growth and decay, the changes happenings in our world are under study to a microscopic precision with the implements we have created to communicate between the world and our senses. Each and every species carry an equally valid impression of the sensory world as that of humans and the implements we have created speak only of our own handicaps or eccentricities rather than any superiority on a fundamental level in the comprehension of the Universe. This is the situation that inspired the ancient Indian Ṛṣis to describe the phenomenal Universe as Māyā. Not only the physical phenomena the abject mystery and misery of human life has no comprehensible definitions and any logical approach to understand or explain the unfolding of life invariably end upon the abstract concepts like 'Niyati', which I think can be translated without loss of meaning as 'Destiny'. These abstract conceptions are all nothing but Time in disguise and life according to commonsense is not much different from what William Shakespeare has described:

"Tomorrow and tomorrow and tomorrow

Creeps in this petty pace from day to day

To the last syllable of recorded time

And all your yesterdays have lighted fools

The way to dusty death; Out out brief candle;

Life's but a walking shadow, a poor player

That struts and frets his hour upon the stage

And then is heard no more

It is a tale told by an idiot

Full of sound and fury signifying nothing".

In the words of Alexander Dumas, Destiny is:

"There is in the life of every man an instant which decides his entire future. Although this moment is so important, it is rarely prepared for by calculation or directed by the will. Almost always it is chance which takes the man, like the wind does a leaf, and throws him in a new and unknown channel where, once he has entered it, he is obliged to obey a superior force, and where, quite believing he is following his own free will, he becomes the slave of circumstances and the plaything of events".

Destiny, the unavoidable - miserable existence and death - have inspired man from the very beginning to contemplate over the mechanism of life and ways to have control over it. While the pre-human stages of consciousness were all subservient to nature, Man differed significantly and took over the reigns of evolution in his own hands and this intellectual development lies at the very root of the Hindu civilization that produced the great Sages. In other words, Man ceased to be the slave of nature and discovered for himself the path of liberation – the path of Yoga – from the chain of births and deaths. As would be expected, the process of transcending death – Yoga - could not have been invented in a day or two – the civilization that produced the great seers who have produced the loftiest thoughts enshrined in the Vedas, Upaniṣads, Purāṇas and the Epics could not have been primitive as is being portrayed by the modern historians – and we need to presuppose the existence of a long history of development behind the evolution of Yoga. In fact the term 'Yoga' may prove insufficient in describing the Vedic/ Tāntric way of life that leads one to the transcendence of Māya or attainment of mukti and the apt word may be Tantra, the assemblage of Jyotiṣa, Yoga and Āgama, which form the foundation of the Hindu way of life.

3. The Scientific Foundations of the Hindu Way of Life

For a devout Hindu the day begins with worship of Sun by the chanting of Gāyatri, which embody the loftiest of aspirations, the yearning for enlightenment. He lives not only for his happiness but also for the happiness of the entire beings and aims to break free of the chain of births and deaths (saṃsāracakra) by dint of his good deeds. The Hindu way of life which can rightly be described as the debris of the ancient pre-historic Vedic Civilization also prescribe a variety of celebrations and "apparently absurd" practices of Tantra, Yoga, Āgama etc., towards the attainment of mukti. The Hindu religion as extant today is mainly Tāntric centered on the Idol worship of innumerable deities who form the major characters of Hindu mythology. Associated customs and celebrations do tend to have an astronomical basis but there is no uniformity as regards the use of Pañcānga and in different regions different Zodiacs are under use to fix the festivals and muhūrtas and as such these practices defy all scientific and logical considerations. As regards the observance of Hindu religion the prevailing situation raises a number of questions:

• What do the Idol worship and the mythological characters signify? Are they simply products of primitive imagination? What kind of a mechanism and power do the mantras used in the worship invocate?

• Do such religious celebrations carry any rationale or relevance at all? Even among the deities the 'Phallus' (Śivaliṅga) stands out as the most important one worshipped all over India! Does this mean that the whole custom and the galaxy of Hindu Gods are of primitive origin?

• What about the great Temple structures that we see across the length and breadth of the sub-continent- from Kanyākumāri to Badari and Dvāraka to Puri? Are they reflective of only the absurd depths of Hindu idiosyncrasy? If not what scientific foundations do they have?

• When we are ignorant of the rationale of the Idols, what efficacy can be expected of the mantras chanted before the idols? From where do these Idols derive their occult power?

• What is the role of astronomy in the attainment of Hindu religious objectives and what kind of a zodiac do the scriptures recommend for fixing the time, an essential component of the Hindu observances?

No convincing answer is forthcoming for these questions from any corners. We can see the custodians of Hindu society and the preceptors of its religion remaining dumbfounded on being questioned about the validity of its very foundations - its cardinal principles and instruments of faith. Pseudo-yogis, self-styled Ācāryas and Demigods are flourishing today in place of the Ṛṣi-paramparā and they are exporting the Hindu spirituality and wisdom to the west. Neither they are interested in the quest of Truth nor are they concerned about the path of transcendence and deliverance out of Māya with the scientifically conceived principles of Jyotiṣa, Yoga and Āgama śāstras. The Tāntric / Vedic traditions had their beginnings in remote antiquity that stands separated by a dark age from the modern world. Through oral transmission the four Vedas, a number of Upaniṣads, parts of the Vedāṅgas, epic and purāṇic mythology etc., could survive the dark period to reach this modern phase. But as we see in the case of the Indus script, a significant part of the ancient knowledge was lost to the posterity in the dark annals of time and the scientific basis of Jyotiṣa, Yoga and Āgama śāstras forms such a lost wisdom. These remnants of our glorious past were created under an altogether different paradigm of human thinking that existed in a hitherto unknown depth of history and hence in the course through millenniums the secret doctrines were lost perhaps due to break up in the occult tradition. Now at the dawn of the 21st century we are in a position to glean and understand the scientific basis of these disciplines with the advancements in the study of human evolution and biology.

4. Descent of Man

The evolutionary trail of the hominids can be traced back to Lemur like creatures whose descendants climbed down to the ground and learned to walk upright millions of years ago. In due course they became increasingly taller, straighter and developed bigger brains as well as the ability to speak. Fossils of these hominids have been found in Africa where they lived about five million years ago. People belonging to the same species as modern man, early Homo sapiens, lived about 200,000 years ago. The major stages in this evolutionary process can be outlined as follows:

Earliest Man-like creatures: 10,000,000 years ago

Australopithecus	:	5,000,000 BP
First Man like creatures	:	2,500,000
First known tools	:	2,000,000
Use of fire	:	1,200,000
Early Homo sapiens	:	200,000
Neanderthal Man	:	100,000
Modern Man	:	50,000 BP
Earliest carvings	:	30,000 BC
Lascaux paintings	:	16,000 BC
Farming	:	8000 BC
Pottery	:	7000 BC
Farming in Europe	:	3000 BC

This chronology is bound to change with more and more paleontological discoveries as has happened during the period since the first discovery of the fossils of *Dryopithecus* in 1856 by Alfred Fontan. A bewildering array of early hominoid-fossils belonging to the Miocene and Pliocene times could be found since then and this has helped to reinforce the conclusion of Darwin and Huxely that man's ancestry lies among the primates of Miocene and Pliocene ages extending from twenty million to three million years before the present. But as regards the hominids – members of the genus Homo*, of whom Man is the only surviving member – we know very little about their evolution and the extinction of species like Neanderthal, which lived during the Late Pleistocene period from 200,000 years before the present. The last of the Neanderthals could probably survive up to 36,000 years BP and according to certain reports they were an amazing 30 percent larger than the humans living today. Further, a recent study has shown that *the sizes of both body and brain have been on a steady decline over the last 50,000 years after bursts of steep increase in the half million years preceding the decline.* The evolutionary realm of knowledge is almost exclusively morphologically derived as is evident from the fact that the fossils are incapable of speaking more about themselves and their society. What we have come to describe as *Homo sapiens sapiens* or modern humanity is only a very

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* There are only two members of the genus Homo: Homo erectus, which has become extinct about 10,000 years ago and the Homo sapiens. Homo erectus or Pithecanthropus was first discovered in Java in 1891 and the skulls discovered in Australia are suggestive of their existence barely 10,000 years ago.

recent development of the current Holocene interglacial period, a roughly ten to fifteen thousand years stretch of anomalously mild and stable climate accompanied by the retreat of the European ice sheet almost 10,000 years ago. Based on the paleontological evidences such as stratigraphic records that have come to surface, which can never be described as complete or sufficient, the prehistory of modern man till the emergence of agrarian society is described in terms of the different stone ages like:

Paleolithic : ?? – 8300 BC

Mesolithic : 8300 – 6000 BC

Neolithic : 6000 – 4000 BC

Most of these early classifications have been based on the Middle East or European prehistory and they are under challenge from the new discoveries of south and Southeast Asia wherein the Neolithic societies had their emergence as far back as in 13000 or 15000 BC. It is therefore apparent that no final or definite contours can be drawn of the human prehistory on the strength of the evidences available now.

5. Hallmark of Human Evolution from Hominids – Anatomical or Cultural?

• Can the evolution of man from the hominids be identified only on anatomical *considerations? Can there be any other proof or identity for the evolution of man from the* hominids?

Or, to put it differently,

• Can the anatomical proof be regarded as sufficient in the absence of cultural evidences *to ascertain the occurrence of an evolved species?*

To answer this question we need a bit of excursion into paleoneurology, which deals with the interpretation of fossil record in the light of the present day relations between the variety of brains and behaviors in living vertebrates to understand the evolution of mind or biological intelligence. Paleoneurology attempts to correlate the different grades of distribution of biological intelligence among living animals with morphological traits on the presumption that if such a correlation exists certain trends in the evolution of that correlated morphological trait must be evident in the fossil record and this information on the increase and diversification of the trait can be made use of to ascertain the levels of biological intelligence prevalent in different evolutionary phases vis-à-vis successive geological periods. Quantitatively, biological intelligence can be equated with the index of cephalization = (Brain size/Body size$^{2/3}$), which represents the amount of neural tissue in excess of that required for transmitting impulses to and from the integrative centers. Intuitive awareness of the real world is a creation of the nervous system and depending upon the brain every species creates a comprehensible model of the world – its own 'reality' – rather than a metaphysically true picture of the world. Obviously, the quality of the different worlds thus springing into existence among different species must be a measure of the biological intelligence.

A logical extension of the above conclusion from paleoneurology is that just as the perception of reality has a correlation with the level of biological intelligence, the cultural remains of a species do carry the signatures of both their 'reality' as well as 'level of intelligence'. It becomes therefore apparent that the cultural evidences provide a more

explicit reflection of the evolutionary state of mind than the morphological factors deciphered out of the fossils. This superiority of the cultural evidence is of great consequence in understanding the history of Human evolution vis-à-vis certain prehistoric cultural remains of our ancestors.

6. Biological Evolution versus Time

Evolution is synonymous with time. From the Big Bang to the single-cell organisms and to the giant and complex human edifice, time has extended like a thread through the macro and micro- cosmic world. According to Tāntric conception the Universe itself is a giant organism – a living, growing and evolving entity – constituted of the symbolically equivalent parts, microcosm and macrocosm, both evolving in tune with the elusive directions of time. In the lower levels of evolutionary pyramid this harmony is apparent in phenomenon like photo-periodism, the process by which plants and animals keep track of the variation in the lengths of day and night, and other biological rhythms. As for example we can find flowers[1] opening/closing at specific hours and plants[2] that takes specific periods for their growths from seed to seed. In all living organisms a mechanism is necessary to keep time with itself and its environments to regulate the numerous interior processes[3]. Further, for survival, creatures have to adapt themselves to the external day-night and seasonal cycles, which bring forth changes in heat, humidity, food resources and threat to their lives. Until recently it was supposed that the physical environment directly supplied the stimuli for changes in plant and animal behavior. But recent studies have shown that the adaptation is independent of the physical stimuli from environment and organisms have got their on built-in circadian (daily) and annual clocks that operates even in the absence of external signals. Evolution and 'survival of the fittest' are thus dependent upon the ability of organisms to anticipate these cycles by developing appropriate time mechanisms. These mechanisms determine the time of budding of plants, migration of birds, hibernation of animals etc., and have come to be known as 'biological clocks'.

Anatomy of Biological Clocks

In general, a biological clock is constituted of two basic elements:

(a) An internal clock that regulates the processes within the organisms.

(b) A 'synchronizer' such as light or heat, which represents the external rhythm.

In many cases the tiny clocks of cellular occurrence beats out time independently of any outside agents and maintains a rhythm of its own. But under the influence of a synchronizer the multitude of cell-clocks adjust themselves for ticking in unison. In fact, the process of synchronization is only poorly understood. External stimuli have been

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[1] Spotted Cat's Ear: Opens at 0600

African Marigold: Opens at 0700

Scarlet Pimpernal: Closes at 1400

White Water Lily: Closes at 1700

[2] In the literature I could find the example of Argentine Bamboo that takes exactly 30 years from seed to seed.

[3] Evolution and organic life had its progress by means of Cell division, which requires synchronization of numerous internal biochemical processes.

found to be as different as the tides/phases of the moon in the case of marine creatures dwelling near the shore to the subtle patterns of the stars in the case of migratory birds. Recent studies have shown that in mammals the master clock that controls the day-night cycle of activity known as circadian rhythm resides in a small group of nerve cells known as suprachiasmatic nucleus (SCN) located at the base of the brain called hypothalamus. SCN receives the external stimuli such as light through the retinas and resets the clock every day so that the correct rhythm is conveyed to the pineal glands, which produces the required secretions. Even in the absence of external day-night cycle the SCN activity is self-sustaining, by virtue of the specialized clock-genes contained in individual cells. Apart from these brain tissues, many other organs/ cell types also have been found to have innate clock-gene activity and molecular rhythms.

Man stands atop the evolutionary period with a maximum of intelligence but a minimum of instinctual support and a poorly developed biological clock. Man is poor in instinctual time sense and even the sleep-wake cycle is not apparent at birth. As compared with other animals, Man is not bound by any built-in seasonal rhythms for mating or any other activity. This liberation of Man from the instinctual and chrono-biological bonds of nature marked a unique stage in the course of evolution.

7. Man's Conquest of Time

The intelligence of Man gave him the memory of past and foresightedness with which the present could be manipulated towards his advantage. Adaptations like Language and Writing enabled Man for moving back and forth in time by way of communication and in due course the Calendar emerged that facilitated co-ordination and more precision in the planning of future. A growing consciousness of time and Man's ability to handle it by means of abstractive reasoning had been the cornerstone of the prehistoric Indian civilization consisting of the Tāntric and Vedic cults. From the fascinating heavenly canopy the Ṛṣis abstracted the clock as well as calendar and from the realm of experience developed a communication technique distinctly different from that of other animals – the Sanskrit language made up of abstract components: Lexicon, Phonology, Syntax and Semantics – in much the same way. In these achievements we have the evidences of analytical and intuitive wisdom; the ancient society had a full realization of the benefits of contemplation and a meditative conscience. As is evident from Vedic accounts, existential questions shared the mystery of time in the minds of Ṛṣis and they sought out means and ways to transcend the same. Commonsense offered nothing but disappointment as no meaning or purpose could be thought of for the transient existence in an eternal flow of time. Thus began the quest for a truth behind our existence and in due course two cults came into existence viz., Tāntric and Vedic and both ventured to conquer time.

With this background of ideas we can now revert back to the questions that came up under section-3, the scientific foundations of Sanātana Dharma, the rationale of and truth behind the Tantraśāstra – the three-in-one combine of Jyotiṣa, Yoga and Āgama.

8. Tantraśāstra – Discovery of Kuṇḍalini

In popular terms Tantra means:

• The leading or principal or essential part, main point, characteristic feature, model, type, system, framework...

•• Doctrine, rule, theory, scientific work...

••• A class of works teaching magical and mystical formularies, mostly in the form of dialogues between Śiva and Durgā and said to treat of 5 subjects: the creation and destruction of the world, worship of the gods, attainment of all objects, esp. of 6 superhuman faculties, the 4 modes of union with the supreme spirit by meditation.

In more detail as expressed by John Woodroffe:

"... the Tantra deals with all matters of common belief and interest, from the doctrine of the origin of the world to the laws which govern kings and the societies which they have been divinely appointed to rule, medicine and science generally. The Tantra is not only the basis of popular Hindu practice, on which account it is known as the Sādhana Śāstra, but it is the repository of esoteric belief and practices, particularly those relating to yoga and mantra-tattva. Indeed, as regrds the last, which is one of the most peculiar, and at the same time most profound, aspects of Hindu teaching, the Tantra is to such an extent the acknowledged repository of this spiritual science that its other name is the Mantra Śāstra". [4]

Transcribing the Sanskrit terminology into equivalent English terms is an exercise fraught with danger. Keeping this in mind Tantra can be credited with the basic meaning of *science*, provided, we define *science as the path of arriving at the truth.* But difficulty may arise in comprehending this definition as *truth* itself carries a number of connotations. It is therefore necessary to clarify that here truth means the *truth of life.*

Truth of life

In Gītā, the foremost philosophical treatise on life, we can find:II.12:

Natvevāhaṃ jātu nāsaṃ na tvaṃ neme janādhipāḥ
Na caiva nabhaviṣyāmaḥ sarve vayamataḥ paraṃ

"Never was there a time when I did not exist, nor you, nor all these kings; nor in the future shall any of us cease to be".

II.19: *Ya enaṃ vetti hantāraṃ yaścainaṃ manyate hataṃ*
Ubhau tau na vijānīto nāyaṃ hanti na hanyate

"He who thinks that the living entity is the slayer or that he is slain, does not understand. One who is in knowledge knows that the self slays not, nor is slain".

II.20: *Na jāyate mriyate vā kadācinnāyaṃ bhūtvā bhavitā vā na bhūyaḥ*
Ajo nityaḥ śāśvatoyaṃ purāṇo na hanyate hanyamāne śarīre

[4] P.42, Principles of Tantra, Part - I

"The soul is beyond birth and death...it is unborn, eternal..."

II.21: *Nainaṃ chindanti śastrāṇi nainaṃ dahati pāvakaḥ*
Na cainaṃ kḷedayantyāpo na śoṣayati mārutaḥ

"Soul can neither be cut by any weapon nor burned by fire; nor is it withered by wind or water".

Who can believe these words in the light of commonsense? Can the truth of these verses be realized by a rational mind? When, where and how is the soul perceptible?

Further at II.22:
Vāsāṃsi jīrṇani yathā vihāya navāni gṛhṇāti naro'parāṇl
Tathā śarīrāṇl vihāya jīrṇānyanyāṇi saṃyāti navāni dehī

"Just as a person puts on new clothes instead of old ones, the soul accepts a new body after leaving the old one".

XVI.19: *Tānahaṃ dviṣataḥ krūrānsaṃsāreṣu narādhamān*
Kṣipāmyajasramaśubhānāsurīṣveva yoniṣu

" Those who are envious and mischievous, who are the lowest among men, are cast by Me into the ocean of material existence, into various demoniac species of life".

Among the different theologies we have got the most scientific treatment of Creation and manifestation of the Universe in the Hindu epics and purāṇas. Gītā cannot be properly understood without giving due cognizance to such scientific accounts. In fact independent interpretation of the above verses leads one only to a layman's erroneous grasp of Hindu notions on the theory of Karma or Destiny. Theological notions contained in the above verses cannot stand against the revelations of the theory of evolution.

• Can we believe that the Amoeba or the Lemur had its evolution into higher and higher species by virtue of its good deeds?

If Man is to take birth in the lower yonis because of his bad deeds the converse given above must also be true. So if we consider the evolutionary arrow from lower to higher animals we are led to the conclusion that the lower species have got a special affinity for good things than the more evolved creatures. Obviously then Man would have evolved further to become the God under the same arrow of evolution.

• What then is the net content of the above verses of Gīta? Or, What then is the meaning/interpretation that the above verses can be credited with?

Gītā had its origin in prehistory and we have got only very little information about the author and his social background. Depending upon the context that a scholar ascribes, the subjectivity of the scholars can yield different interpretations. Manoranjan Basu has described the situation in the following words:

"...difficulties might crop up at a time when the scriptures are brought down to the level of communicative language. Ācāryas (Spiritual preceptors) interpret them in their own respective ways and various commentaries and elaborate critical notes are made on them, as a result of which the main object for which they were initiated get lost; round about those interpretations of the Ācāryas of different Sects (Sampradāyas) their respective beliefs and ideas come into being. These beliefs and ideas go on from age to age and in course of time form traditions and those traditions give birth to various types of practices on the one hand and ideas on the other. Each and every sect claims infallibility of its own idea, and a mind not used to and initiated in such sectarian religious traditions from the very start finds tremendous difficulties to get the correct interpretation of such Scriptures. To such a mind either all the interpretations are correct or none of them".

We have got a similar situation with the Gītā. Gītā might have grown in its content during the hundreds or thousands of years of prehistory and has gained numerous interpretations. Our modern society tends to accept all of them as correct or as different facets of Lord Kṛṣṇa's magnificent treatise on spirituality. Reason had been the hallmark of spirituality and self-realization in the ancient past; but now we have come to live in a time warp where-in reason is altogether forbidden and the style of spirituality has become acceptance without any doubt or questioning. As against this degeneration of spirituality in modern times, we can find in Bhāgavata III.7.2-7, Vidura seeking the following clarification from Maitreya:

"O holy sage, how can the lord, who is pure consciousness, immutable and unqualified (absolute), come to be associated with attributes and activity even in sport? (2) It is the hankering (for pleasure) and the desire to play with another (child or plaything) that impels a child to betake itself to play. But how can the Lord, who is satisfied in Himself and is ever one without a second, take to play? (3) It was through His own Māyā, consisting of the three Guṇas (Sattva, Rajas and Tamas), that the Lord created the universe. Nay, it is through the same Māyā that He sustains it and shall finally withdraw it. (4) How can He whose knowledge – which is His very nature – is never obscured by space, time or circumstance either by itself or through any other external cause, be associated with Māyā? (5) It is the Lord alone who is present in all bodies (as the enjoyer); how can there be any ill luck for Him, and how can He suffer any agony due to Karmas?"

Note the emphasis given by the present author. Maitreya answered the question, but perhaps indirectly, in terms of Māyā and suggested the way out of 'devotion to Lord' for the individual soul to loose its identity with the body and to realize its oneness with the Lord. Rather than digressing here to discuss the merits of Maitreya's answer we shall revert to the earlier discussion on Gītā with the rational mind of a Viduraḥ to seek a right interpretation of the verses cited. Perhaps the best known of Kṛṣṇa's verses is:

Karmaṇyevādhikāraste mā phaleṣu kadācana
Mā karmaphalahetur bhūrmā te saṅgo'stvakarmaṇi

Kṛṣṇa has placed an ideal before the world, which perhaps no one has ever practiced. If Kṛṣṇa's statement is accepted, what for is then life? In fact, Joseph Stalin could have quoted Kṛṣṇa before the inmates of Siberian labor camps!

• Can the words of Kṛṣṇa be so life denying? What is life with nothing to aspire for?

In fact the *transcendence of phalecha* itself is *mukti*. What a greater *mukti* can we think of? What is the *mukti* that Kṛṣṇa is promising? "Attaining the feet of the Lord" – what does this mean? A life after death at his abode – Vaikuṇḍaṃ? If the *mukti* is to be realized after life, what then is the truth of life? Divested of the mythological attire what is Kṛṣṇa, Viṣṇu or the God himself in Hindu theology? What is the source of Gītā's authority on spiritual matters if Kṛṣṇa fails to be on the pedestal of God? In other words can we take these verses on their face value?

We cannot, because Gītā's ultimate objective was political rather than spiritual. It is spirituality bottled for socio-political means; Gītā took shape in the context of a war – amidst a socio-political crisis wherein true spiritually is seldom addressed to. The aim of Gītā was to facilitate a war, to dispel the fear of death and sin of killing from a wavering mind. In all ages Master statesmen have resorted to such eloquence to make their armies move ahead. The theory of life apparent in Gītā is a logically consistent explanation of the experience of life by an intellectually advanced society. Evolution had brought in enough existential questions in human mind as to make him loose his peace of mind eternally. The less intelligent could survive on the acceptance of established doctrines but frustration awaited the rebellious spirit who failed to discern any purpose or meaning for life. Evolution has brought forth a species having the will as well as capacity to commit suicide. This is where the need arose for a control over the mind to restrain it from a course towards its ultimate doom impelled by a sense of existential vacuum – as narrated by Shakespeare the feeling of: *"Life's a tale told by an idiot, full of sound and fury signifying nothing..."*. For the society to survive it needed some logical conundrums capable of pinning down the average minds and it was this necessity that inspired the metaphysical constructions like Gītā to halt an average man's quest for the truth of life. The verses quoted above from Gītā are meant to serve this purpose only and they do not reflect the truth of life or represent the spiritual wisdom of the Ṛṣis in Toto. In fact, the true spiritual wisdom of the Ṛṣis rests within Kṛṣṇa and this is what rendered him superiority over others:

Superiority of Kṛṣṇa

Mythological profile of a God incarnate or Avtār has served to camouflage the true identity of Kṛṣna evident at XVIII.78:

Yatra yogeśvarakṛṣṇo yatra pārtho dhanurdharaḥ I
Tatra śrīrvijayobhūtirdhruvā nītirmatirmama II 78 II

We cannot loose sight of this concluding verse of Gīta, which describe Kṛṣṇa as Yogeśvara. Yogeśvara Kṛṣṇa in fact is the God and the ultimate attainment as well as realization. This attainment or realization has to happen in life rather than as an after-life sojourn into a realm of bliss by the individual soul. Mukti, thus is the realization of a man's

potential to evolve into a Kṛṣṇa, Buddha or Jesus. This accomplishment is possible only through Yoga – self-controlled evolution and transcendence of māyā by the realization of a potential dormant in us viz., Kuṇḍalinī, the serpent power.

Tantra achieves the above objective through means abstract to common man. Only very little authentic information is available as regards the original theory and practices and what we see and hear today about Tantra is only superficial accounts from non-initiates. The focus of Tantra itself probably remains shifted from its ultimate objective of mukti to selfish attainments of siddhis or super-human powers and thus what we have come to know is only the debris and degenerated state of a path that once promised grace divine, immortality to the human beings. Modern outlook is one of scoffing at the claims of siddhis by the Tāntrics. The theory popularly known in symbolic terms also gets derided due to lack of comprehension by modern minds. The following excerpts from A.L. Basham's – 'The Wonder That Was India' – is illustrative of the modern trends in thinking:

"The chief vein of the body, known as suṣumna runs through the spinal column. Along it at different points are six " wheels" or concentrations of psychic energy. At the top of the vein suṣumna within the skull, is sahasrāra, a specially powerful psychic center symbolically referred to as a lotus. In the lowest "wheel", behind the genitals, is the Kuṇḍalinī, the "Serpent power", generally in a quiescent state. By yogic practices the Kuṇḍalinī is awakened, rises through the vein suṣumna, passes through all the six "wheels" of psychic force, and unites with the topmost sahasrāra. By awakening and raising his kuṇḍalinī the yogi gains spiritual power, and by uniting it with Sahasrāra he wins salvation.

The awakened Kuṇḍalinī gives to the yogi superhuman power and knowledge, and many yogis have practiced yoga rather for this than for salvation. Some adepts of this form of yoga have developed powers which cannot fully be accounted for by European medical science and which cannot be explained away as subjective but the physiological basis of laya - and hatha -yoga is certainly false; there is no kuṇḍalinī, suṣumna or sahasrāra. The ancient mystical physiology of India needs further study, not only by professional Indologists, but by open-minded biologists and psychologists, who may reveal the true secret of the yogi. For whatever we may think about his spiritual claims there is no doubt that the advanced yogi can hold his breath for very long periods without suffering injury, can control the rhythm of his own heart-beats, can withstand extremes of heat and cold, can remain healthy on a starvation diet, and, despite his austere and frugal life and his remarkable physical contortions, which would ruin the system of any ordinary man, can often survive to a very advanced age with full use of his faculties".

Pseudo Spiritualism

Hindu society in general today understands the Hindu religion mostly based on the works of Svāmi Vivekānanda. Even though Svāmiji was the spiritual heir to the Tāntric wisdom of Rāmakṛṣṇa, his views on the Hindu religious foundations took shape under the influence of the 19th century Calcutta, which probably despised Tantra under the western / Brahma Samāj influence. He has credited the title Śruti exclusively to the Vedas and Upaniṣads, which I think is a serious error that even his great successors like Svāmi Raṅganāthānada have also not bothered to correct in their discourses. It is one of the greatest irony of our times that the Rāmakṛṣṇa Mission which evolved out of the spiritual grace of one of the greatest Tāntric masters of India has never a spoken a word about the Tantra and the Indian antiquity /spiritual heritage has been wholly credited to the Vedas.

It is really doubtful as to what sense Svāmiji intended to convey by the use of the word Vedas. Going by the spirit of what he has said - as understood by the present author –

perhaps he used the word as a substitute for the spiritual wisdom of both the Vedas and Tantras. In his address at the Parliament of Religions, Chicago, Svāmiji has said:

"*It may sound ludicrous to this audience how a book can be without beginning or end. But by the Vedas no books are meant. They mean the accumulated treasury of spiritual laws discovered by different persons in different times. Just as the law of gravitation existed before its discovery, and would exist if all humanity forgot it, so is it with the laws that govern the spiritual world. The moral, ethical and spiritual relations between soul and soul, and between individual spirits and the father of all spirits, were there before their discovery, and would remain even if we forgot them*".

But elsewhere he had been more explicit in ascribing the title Sṛuti exclusively to the Vedas and in describing the Tantra as forming a part of the Smṛtis.

"*Two ideals of truth are in our scriptures: the one is that we call the eternal, and the other is not so authoritative, yet binding under particular circumstances, times and places. The eternal relations between souls and God are embodied in what we call the Śṛutis, the Vedas. The next set of truths is what we call the Smṛtis, as embodied in the words of Manu, Yājñavalkya, and other writers, and also in the Purāṇas, down to the Tantras...*" [5]

What really constitute the Sṛutis and Smṛtis

The foundations of the Sanātana Dharma are what the Acaryas have chosen to describe as Śṛutis and Smṛtis. A common man seldom understands what these terms really mean or their contents. Śṛuti, is the generic term that denotes the sum total of metaphysical truths or supersensory knowledge of Man's inner self, which exists irrespective of our cognizance or discovery of them. The religious scriptures form an admixture of Sṛuti with extraneous matters such as cosmological speculations, existential deliberations, myths and a set of rules and regulations aimed at guiding the individual and collective psyche of the particular religious sects. Such extraneous matter which constitute sacred books are known in the Hindu tradition as Śmṛti and in this class are placed the Epics, Gītā, Purāṇas and the dictates of Manu and Yājñavalkya. Śṛuti is eternal where as Smṛtis are temporal like the bark of a growing tree that undergoes successive replacement. It is important to note that if such replacements do not take place the Smṛti that sustained society in one age may sabotage it in another age.

When examined against the above perceptions on Smṛtis as available in the writings of Svāmi Raṅganāthānanda, Tantra certainly qualifies to be referred as Śṛuti rather than as forming part of the Smṛtis as was described by Svāmi Vivekānanda. This contempt for the Tantra had been widely prevalent in the 19th century due to the superficial outlook maintained by many scholars. As for example:

→ "The Tantras are a later development of the Purāṇic creed. They are the writings of Śāktas or votaries of the female energy of some divinity, mostly the wife of Śiva. Such ideas are not altogether absent in the Purāṇic works. But in the Tantras they assume a

[5] Complete Works: III: pp.248 –251

peculiar character, owing to the admixture of magic performances and mystic rites of perhaps an indelicate nature. Amarasiṃha knows not of them".[6]

On the contrary Dr. V.V.R. Sāstry says:

"The Āgamas contend that they constitute the truest exegesis of the Vedas, and their origins are certainly as ancient as those of some of the classical Upaniṣads. If the Fire worship be regarded as the ritual inculcated in the Vedas as the outer symbolism of spiritual truths, the temple worship may, on its side, be also said to assume a similar importance in regard to the Āgamas. For the rest, it will be seen that in India at the present day there is hardly a Hindu who does not observe some kind of temple worship or another, which points to the conclusion that the Āgamas have had, in one form or another, an universal hold upon the continent of Hindu India, and that *their influence* tells".[7]

This view of Sāstry receives substantiation in the Mahābhārata, Śāntiparva, chapter 284:

Vedāt ṣaḍaṅgādudghṛtya sāṅkhyayōgācca yuktitaḥ I
Tapaḥ sutaptaṃ vipulaṃ duścaraṃ devadānavaiḥ II 187 II

Apūrvaṃ sarvatōbhādraṃ sarvatōmukhamavyayaṃ I
Abdairdaśāhasaṃyuktaṃ gūṭhamaprājṅaninditaṃ II 188 II

Varṇāśṛamakṛtaidharmaiviparītaṃ kkacitsamaṃ I
Gatāntairadhyavasitamatyāśṛamamidaṃ vṛtaṃ II 189 II

Mayā pāśupataṃ dakṣa śubhāmutpāditaṃ purā I
Tasya cīrṇasya tat samyak phalaṃ bhavati puṣkalaṃ I
Taccāstu te mahābhāga tyajyatāṃ mānasō jvaraḥ II 190 II

Leaving aside the adjectives, the verses means: Lord Śiva says: I have extracted the auspicious Pāśupata Tantra out of the Vedas and Vedāṅgās in antiquity. Dakṣa, I am bestowing upon you the grace of Pāśupata, which is superior to all other śāstras and opposed to Cāturvarṇyam - suitable to all Āśṛamas and castes to attain bliss.

Coming back to the criticism of Svāmiji's views, whatever he spoke at Chicago of man's divinity and universal religion were all Tāntric precepts and not at all Vedic:

"If there is ever to be a universal religion, it must be one which will have no location in place or time; which will be infinite like the God it will preach and whose sun will shine upon the followers of Kṛṣṇa and Christ, on saints and sinners like; which will not be

[6] Krishnamacharya, M., 'History of Classical and Sanskrit Literature' p.34, quoted by Woodroffe in 'Principles of Tantra' at page 33.

[7] P.43 'Principles of Tantra', Dr. V.V.R Sastry, in his Introduction to J.M.Nallaswami Pillai's "Studies in Śaivasiddhānta".

Brāhmanic or Buddhistic, Christian or Mohammaden, but the sum total of all these, and still have infinite space for development; which in its catholicity, will embrace in its infinite arms, and find a place for every human being, from the lowest groveling savage not far removed from the brute, to the highest man towering by the virtues of his head and heart almost above humanity, making society stand in awe of him and doubt his human nature. It will be a religion which will have no place for persecution or intolerance in its polity, which will recognize divinity in every man and woman, and whose whole scope, whose whole force, will be centered in aiding humanity to realize its own true, divine nature".

It is in Tantra we find a Universal religion and a casteless society where men and woman pursue spiritual bliss on an equal footing:

Mahānirvāṇa Tantra: Chapter XIV:

Caṇḍālaṃ yavanaṃ nīcaṃ matvā striyamavajńayā I
Kaulaṃ na kuryyādyaḥ kaulaḥ sō*f*dhamō yāntyadhōgatiṃ II 187 II

"Kaula, who refuses initiation to Caṇḍāla or Yavana considering them as inferior or denying initiation for a woman out of contempt, falls from grace and reduces himself to an object of contempt".

Ye ye varṇāḥ kṣitou santi yadyaddharmamupāśṛitāḥ I
Kaulā bhavantaste pāśourmuktā yānti paraṃ padaṃ II 189 II

"All Varṇas (castes) on the earth, irrespective of the religion they practice can break themselves free of the bond of Karma by becoming a Kaula".

We see here the true spirituality that allows only one caste one religion and one God and similar conceptions are not traceable in the Vedic literature. In this context we must remember that Ādi Śaṅkara himself had been an adherent to the Brāhmnic classification of 'Man the divine' into four different castes - Cāturvarṇyaṃ - and as per legends it was Śiva assuming the form of a Caṇḍāla, who made him realize the purity of soul in all creatures. This incident is illustrative of the lacunae the Vedic thought had in terms of true spirituality and universal appeal and quest for Truth that we see in the Upaniṣads is the contributiuon of Tantra – as for example, the Upaniṣads may be Vedic interpretation of the Tāntric precepts.

As I have mentioned at the outset the true meaning of the śrutis and smṛtis no longer exists as interpretations over interpretations have served to obliterate the truth. The religion of the Hindus has become a bunch of practices devoid of any rationale and a few irrational beliefs. In the words of Svāmi Raṅganāthānanda, such conditions occur as a result of:

"*Much of the irrelevance of the world's religious traditions today proceeds from their inability to separate the Śruti, or the essential, from the Smrti, or the obsolete contents, the eternal spiritual truths from the historical socio-political dogmas, in these traditions, and their unwillingness to throw overboard the latter which have ceased to have any*

currency value in the changed conditions and their incapacity to forge new Smrtis in response to the new demands". [8]

Arnold Toynbee too has expressed similar views on the degeneration taking place in religions:

"*Thus, in our society in our time, the task of winnowing the chaff away from the grain in mankind's religious heritage is being forced upon us by a conjunction of social and spiritual circumstances... In the life of all higher religions, the task of winnowing is a perennial one because their historic harvest is not pure grain. In the heritage of each of the higher religions, we are aware of the presence of two kinds of ingredients. There are essential counsels and truths, and there are non-essential practices and propositions. The essential counsels and truths are valid at all times and places, as far as we can see through the dark glass of mankind's experience up to date... But at the same time these same higher religions are historical institutions; and they have been making a transit through space-time in which, at every point-moment in their trajectory, they have been encountering the local temporary circumstances of human life... These accidental accretions are the price that the permanently and universally valid essence of a higher religion has to pay for communicating its message to the members of a particular society in a particular stage of this society's history*". [9]

As a result of the decadence inherited over millenniums the traditional spiritualism is perpetuating wrong notions all around by making people accept the spiritual notions unquestionably. Through similes and parables Ācāryas have created an apparently convincing framework of pseudo spiritualism. Faith has never been at the center stage of Vedic or Tāntric Dharma, which were founded on intellectual inquiry and experience of the truth. On the contrary today people are led to believe in *ātma, mukti* and other jargon of Vedānta under the pretext that intellectual inquiry is forbidden in the light of Guru's teachings. Nothing may be more absurd in spirituality than preventing the spirit of inquiry from maturing. Ban on intellectual inquiry is a must to protect the pseudo spirituality of make believe conceptions such as the possession of ātma by animals and their ascendancy to human birth and vice versa by virtue of one's deeds etc.

• What is that *ātma* which is capable of traversing even the genetic boundary between two species? If at all *ātma* exists it must be a product of evolution and by its attributes it qualifies to be the end product. How can it switch between two species?

Tantra – the only answer

Man is born like every other creature and no special morphological seat could be found in human body for the ātma. There is absolutely no basis to pre-suppose that every individual is born into this world with an ātma. Ātma if it exists, can only be something that had its evolution within a human body. The attribute of eternity does not fit within the framework of such a thesis unless we provide for a mechanism of development or crystallization of self in a human being. Such a self can hypothesized to be eternal in a

[8] The Message of the Upaniṣads, p.9
[9] A Historian's Approach to Religion, pp.262 – 264

cycle of births and deaths until it is guided to a state of passivity in a loftier state of so-called spiritual bliss. No amount of Vedānta can help one in masterminding one's own evolution to such a stage of divinity, which really is the Vedānta – ultimate end of Vedic pursuit. Neither Karma nor Jñāna yoga can do it – only Tantra is the answer.

Man had his descent with the fear of mṛtyu inherent in him and he has sought eternity by all means since pre-historic times. In the Hindu conception mṛtyu is a synonym of Kāla, the Time. In their effort to transcend time, Hindus deified time in numerous forms such as Brahma, Viṣṇu, Rudra, Kāla, Kāḷi etc. The worship of an abstract concept like "Time" cannot be noticed elsewhere and is a unique feature of the Hindu way of life that distinguishes itself from the general class of dogmatic religions. How could Time – an abstraction having neither a conceivable beginning nor a foreseeable end, which appears to be an incessant flow beyond the grasp of anyone – assume such importance in our civilization as to become the source of the major mythological characters? No explanation is possible unless we pre-suppose the existence of great wisdom among the pre-historic sects.

We saw earlier under section-5 that the cultural remains of a species do carry the signatures of both their 'reality' as well as 'level of intelligence' and as such the cultural evidence is of supreme significance than the morphological evidence in assessing the placement of a species in the evolutionary chain. Against the backdrop of this inference how shall we interpret the obsession of ancient men with an abstraction like Time and pursuit of eternity? Can this be not taken as the footprint of an intellectually advanced species under a different cultural paradigm? Evolutionary phenomena do not deny such a possibility. Contrary to what we generally tend to believe evolution has not been a process of streamline advancement – during the past few million years there could have evolved a number of species answering to the above possibility. To quote a recent source:*

" Our biological history has been one of sporadic events rather than gradual accretions. Over the past five million years, new hominid species have regularly emerged, competed, coexisted, colonized new environments and succeeded – or failed. We have only the dimmest of perceptions of how this dramatic history of innovation and interaction unfolded, but it is already evident that our species, far from being the pinnacle of the hominid evolutionary tree, is simply one more of its many terminal twigs".

The following observations of the author are also noteworthy in the above context:

" Although the source of H.Sapiens as a physical entity is obscure, most evidence points to an African origin perhaps between 150,000 and 200,000 years ago. Modern behavior patterns did not emerge until much later. The best evidence comes from Israel and environs, where Neanderthals lived about 200,000 years ago or perhaps even earlier. By about 100,000 years ago, they had been joined by anatomically modern H.Sapiens, and the remarkable thing is that the tools and sites the two hominid species left behind are essentially identical. As far as can be told, these hominids behaved in similar ways

* Scientific American, January 2000: 'Once We Were Not Alone' by Ian Tattersall. P.43.

despite their anatomical differences. As long as they did so, they somehow contrived to share the Levantine environment.

The situation in Europe could hardly be more different. The earliest H.Sapiens sites there date from only about 40,000 years ago, and just 10,000 or so years later the formerly ubiquitous Neanderthals were gone. Significantly, the H.Sapiens who invaded Europe brought with them abundant evidence of a fully formed and unprecedented modern sensibility. Not only did they possess a new "Upper Paleolithic" stone working technology ...they brought with them art, in the form of carvings, engravings and spectacular cave paintings...their living sites were highly organized, with evidence of sophisticated hunting and fishing. The pattern of intermittent technological innovation was gone, replaced by constant refinement. Clearly these people were us".

Author has credited the extinction of Neanderthals to a newfound sensibility among the *Homo sapiens.*

" To understand how this change in sensibility occurred, we have to recall certain things about the evolutionary process. First, as in this case, all innovations must necessarily arise within preexisting species – for where else can they do so? And second, many novelties arise as "exaptations," features acquired in one context before (often long before) being co-opted in a different one. For example, hominids possessed essentially modern vocal tracts for hundreds of thousands of years before the behavioral record gives us any reason to believe that they employed the articulate speech that the peculiar form of this tract permits. Finally, we need to bear in mind the phenomenon of emergence whereby a chance coincidence gives rise to something totally unexpected. The classic example here is water, whose properties are unpredicted by those of hydrogen and oxygen atoms alone.

If we combine these various observations we can see that, profound as the consequences of achieving symbolic thought may have been, the process whereby it came about was unexceptional. We have no idea at present how the modern human brain converts a mass of electrical and chemical discharges into what we experience as consciousness. We do know, however, that somehow our lineage passed to symbolic thought from some non-symbolic precursor state. The only plausible possibility is that with the arrival of anatomically modern H. sapiens, existing exaptations were fortuitously linked by some relatively minor genetic innovation to create an unprecedented potential...

It is impossible to be sure what this innovation might have been, but the best current bet is that it was the invention of language. For language is not simply the medium by which we express our ideas and experience to each other. Rather it is fundamental to the thought process itself. It involves categorizing and naming objects and sensations in the outer and inner worlds and making associations between resulting mental symbols. It is, in effect, impossible for us to conceive of thought (as we are familiar with it) in the absence of language, and it is the ability to form mental symbols that is the fount of our creativity, for only once we create such symbols can we recombine them and ask such questions as " What if...?"

Emphasis added by the present author must be noted. Language is the critical improvisation that catapulted man into an orbit of glory as compared to the other organisms and linguistics had its height of glory in ancient, prehistoric India. Prehistoric India thus depicts cultural evidences of the sporadic appearance of a variant species obsessed with metaphysics and it was they who brought into this world the concepts of eternity such as ātma and mukti. Full comprehension of these abstractions may be difficult from a different evolutionary frame.

Tantra can be properly understood only against the above background.

9. Tantra and Veda – No Conflict

In the last decades of nineteenth century, astronomical interpretations of Vedic hymns by scholars like Bāla Gaṅgādhara Tilak had pushed the antiquity of Vedic literature to periods such as 4000 - 6000 BC and as such it was generally believed that the Indian culture has its roots in the Vedas. Tantra was looked upon as an anterior development authored by those who have fallen from the Vedic path. But the Subsequent discovery of the Indus Valley civilization and the evidences that came to light of an ancient Tāntric cult altered the situation drastically. In the words of Marshall:

"Among the many revelations that Mohenjo-daro and Harappa have had in store for us, none is perhaps more remarkable than the discovery that Śaivisṃ has a history going back to Chalcoli age or perhaps even further still and that it thus takes its place as the most ancient living faith in the world".

Also according to Manoranjan Basu:

"Belief in Śiva in the form of Paśupati goes back to those days of antiquity that may be said to be as pre-historic in terms of chronology... The eight aspects (aṣṭa-mūrti) of Śiva are found in the Āgamas, in the Vedas, in the Purāṇas and also in Saṃhitāas and similar other texts. The immanent aspect of Śiva's Vedic counterpart Rudra is found in the Śatarudrīya hymn of the Yajurveda, in certain passages of the Atharvaveda (cf.VII.87.1: XI.2.1) and also as a legend in two of the most important Brāhmaṇas such as Śatapatha and Śaṅkhayana... The foregoing observations of some of the relevant facts of the ancient Indian History reveal that the original culture of India is basically Śiva-Śakti-centric; The Vaidika, non-Vaidika streams are essentially matters of religious practice, discipline and mode of worship. Each stream has got its definite goal to achieve. The goal of the Yajña-centric elaborate ritualism of the Veda is to achieve Swarga, an abode of perpetual bliss and joys by invoking and propitiating different Gods and Goddesses through incantation, proper accentuation and chanting of the mantras; whereas the other stream aims at gaining perfection and fullness of life through physical, psychical and spiritual practices (sādhana) and finally going beyond the natural and achieving a state of transcendence, otherwise designated as freedom. Both the streams meet and forms a grand synthetic whole covering the four-fold Indian Values of life such as Dharma, Artha, Kāma and Mokṣa".

Scholars have unanimously regarded the Mahāyogi of Harappā as Lord Śiva of Pāśupata Tantra and this identification has brought forth the question - Whether the civilization was Vaidika or non-Vaidika? - Aryan or non-Aryan & pre-Vaidika?

We have no sufficient evidence to declare the Indus Civilization as either exclusively Tāntric or Vedic. Going by the stature gained by Śiva and Yoga in the Epics and Purāṇas, the present author is inclined to favor a theory of coexistence of both the Tāntric and Vedic cults as two different streams of India's cultural life. Tāntric authors and commentators kept themselves outside the pale of the Vedic tradition while the Vedic priests, almost exclusively Brāhmins, subscribed to Tantra remaining within the Vedic tradition and the glimpses of this secretive alliance can be found strewn along all over the Epics and Purāṇas. A remarkable example is the Gītā that extols the merits and superiority of Yoga, an un-acknowledged borrowing from the Tāntric tradition. Like the Tantras, the Vedas too probably contained esoteric wisdom the real meaning and significance of which were forgotten as the terminology became obscure in due course.

Whatever may be the real facts of origin, the present day Hindu way of life can rightly be considered as emerging from a confluence of the Tāntric and Vedic cults that took place in remote antiquity. The Tāntric cum Vedic tradition as extant today is mainly centered around the Āgamic Idol worship and the Vedānta oriented pursuit of an illusory absolute. This modern phase of our civilization stands separated by a dark age from the pre-historic cults. Through oral transmission a number of Tantras, the four Vedas and the associated literature, a number of Upaniṣads and a huge volume of mythology in the form of Epics and Purāṇas could survive the dark period to reach this latter phase. These remnants of the glorious past were created under an altogether different paradigm of human thinking and hence their real meaning has so far remained elusive for the modern minds. As for example: We have been constantly trying to impose our own artificial meanings upon the Vedic hymns and the Purāṇic mythology - a few have made *Indra* the chief of nomadic tribes who overrun the Indus Valley Civilization, Viśvāmitra their Priest... Mahābhārata the local feud within a tribal clan etc. - a few have tried to read the true history of out of them and have gone to the extent of fixing the time of birth of certain epic/purāṇic heroes - lastly, a minority have found the mythology as an allegorical language containing astronomical information. All these approaches have remained hitherto simply speculations and inconclusive. No convincing explanation is available for certain salient features of Hindu mythology such as innumerable Gods having apparently absurd descriptions- who form the major characters of epic/purāṇic dramas - unbelievable episodes and chronology, astronomical characters appearing in the drama - Sun, Moon and Time in its numerous personified forms like Brahma, Viṣṇu, Rudra, Kāla, Kali etc.

In a nutshell, there is all round confusion and mystery when we try to understand the Indian antiquity and this may be the result of some deficiency in our approach or may be because what has come down to us through the ages is only partial. Present author is of the conviction that our approach so far lacked the most important dimension required to comprehend Indian antiquity and that is Tantra and Jyotiṣa, the science of Kuṇḍalinī and time.

10. Origin of Astronomy and Āgamas

As noted above the religion under practice by the Hindus or the present day Hindu way of life is almost exclusively based on the Tāntric precepts and has very little affiliation to the Vedas. Very few people today attach any importance to the ordainments of Śrutis and Smṛtis and the holy fire has become almost extinct and it is only the sacred thread that remains of the Brāhmnical or Vedic religion[10]. The religious fervor of the Hindus exclusively arise out of the Āgamic cults which in its early phase was a scientific pursuit of Yoga devoid of the mythological morasses acquired in the course of time. Time was an instrument in their hands that facilitated Yogasiddhi and we may perhaps fail to comprehend such paradigms of thinking as that of the Tāntrics without proper initiation and pursuance of the discipline. Kālacakra tuned their microcosmic spirits to the macrocosm and as is usual with the occult disciplines the underlying principles were expressed in cryptic symbolic terms. Generally the worship of the Phallus and the Serpent are looked upon as aboriginal practices but the discussion we had already on the zodiac stands to refute such views. Such strange customs of worship were instituted based on the science of symbolism known only to the early Ācāryas of the Tāntric tradition and with the degeneration of the discipline the underlying astronomical secrets and the zodiac or Tāntric Time itself was lost to the cults that existed over the vast expanse from ancient Egypt to the eastern sectors of Asia. It was the wide prevalence of the Tāntric cults that made the zodiac and worship of Time a common heritage[11] to all civilizations. As we have already seen, Time or Kālacakra conceived as Mūlādhāra Rāhu – Śikhi Cakra formed the basis of the Tāntric worship of Sarpa and Liṅga. Not only Indian astronomy and zodiac but also the Babylonian or Chaldean developments owe their origin to the cults that worshipped Time as the Serpent and Phallus. Prevalence of these customs both in Babylon as well as India point towards cultural invasion or migration of tribes between these distant places. One of the most noteworthy aspects of this prehistoric phenomenon is the prevalence of Serpent and Phallus worship in all its pristine glory in Kerala, one of the cradles of Indian Astronomy, which had strong cultural contacts with the Middle East.

It is therefore apparent that the history of astronomy cannot be well understood without giving any cognizance to the prehistoric cults that worshipped time in its strange symbols of Serpent and Phallus. R.G.Bhandarkar in his work "Vaiṣṇavisṃ, Śaivisṃ and Minor Religious Systems" first published in 1913 has traced the beginnings of Śaivisṃ to the Vedic god Rudra who personified the dreadful and destructive phenomena of "the storms that uproot trees and demolish houses, accompanied the thunderbolt which strikes down men and beasts dead in a moment and the epidemics that rage and carry off numbers of men". This is reflective of the dangers that imagination causes in the articulation of history

[10] Iyengar, PTS, History of the Tamils, p103.

[11] *Moreover all the world religions or metaphysical doctrines profess salvation or mukti to the soul / Ātma* based on borrowed Tāntric wisdom of the prehistoric times and what they promise is beyond their comprehension and hence all religions forbid inquisitiveness under the pretext that all truths cannot be verbally expressed.

without appropriate evidences to testify the conjectures that are continuously drawn within limited horizons of knowledge. According to Dandekar:

"*This theory put forth by RGB is characterized by the two common assumptions of early Indology, namely (1) that the origin of everything Indian has ultimately to be traced back to the Veda and (2) that the Vedic gods are basically personifications of natural phenomena. It however needs to be emphasized that the real popular religion, which was essentially distinct from the Vedic religion, remained outside the purview of the Veda. The Veda, it must be realized, does not teach us everything on ancient social and religious conditions of even Aryan India. It may be said to have emanated from a narrow circle of poet-priests, and reflects a somewhat singular view of things. Long before the advent of the Vedic Aryans, there had prevailed in various parts of India widely spread and deeply rooted popular religious cults. Though they might have apparently suffered a kind of set back on account of the onslaught of the freshly vigorous Vedic way of life and thought, some of them proved influential enough to compel sponsors of Vedism to accommodate them, in one form or another, in the frame work of their religious ideology. And when in the course of their religious history of India Vedism began gradually to decline, these popular religious cults again came into their own and confirmed themselves as the religion of the people. Such in broad outline is the genesis of Vaiṣṇavisṃ, Śaivisṃ and other minor religious sects which together constitute the major part of the classical Hinduism*".

Dandekar goes on to illustrate as to how a pre-Vedic non-Aryan Rudra was adopted into the Vedic religious ideology with detailed quotations from the Vedas. After giving a summary of the Vedic descriptions of Rudra, Dandekar concludes:

(a) "*On account of all such features, Rudra stands out almost segregated from the generality of Vedic gods. Notwithstanding this the Veda cannot be said to exhibit any open opposition to Rudra worship as such. There is no doubt that the Rudra-cult was entirely alien to the Vedic milieu, but, under the pressure of certain peculiar circumstances, it had to be accommodated, howsoever haltingly, into the Vedic religious complex*".

(b) "*There is sufficient evidence to justify the assumption that Rudra is but the Vedic version of a well-established pre-Vedic non-Aryan popular god. The religious cult centering round this proto-Indian god had spread far and wide – different aspects of that god and different forms of his worship having been emphasized in different regions of the country. The essential common basis of that religion is, however, quite unmistakable. This popular proto-Indian religion differed from the Vedic religion in many significant respects. For instance that religion was iconic, that is to say, the followers of that religion worshipped their god in the form of some concrete symbol, which was installed either in the open or within some temple-like structures, which were usually erected away from the main settlements. The Vedic religion, on the other hand, generally did not know of any temple or image worship.... The proto-Indian worship consisted mainly of Pūjā and Bali, that is, the offering, made directly to the god, of raw flesh and blood. This mode of worship thoroughly contrasted with the Vedic ritual or homa in which usually cooked oblations (or Soma) were offered to the gods, not directly but through the sacrificial fire, in the accompaniment of mantras. Like idol-worship, the word Pūjā and also the religious*

practice denoted by that word were adopted by Brāhminism during the Sūtra – Vedāṅga period and that too presumably for the very reason for which idol worship was adopted. Some of the other features of the proto-Indian religion, which clearly differentiated it from the Vedic religion, were Yoga, penance and austerities, phallic cult, the god's lordship over animals and association with serpents, fertility rites, importance given to Mother Goddess and to female divinities and the propitiation of the spirit of the dead and their leader".

Scholars have almost unanimously identified the Mohenjo-daro God – "*the God, who is three faced, is seated on a low Indian throne in a typical attitude of yoga with legs bent double beneath him, heel to heel, and toes turned downwards. His arms are outstretched, his hands with thumbs to front resting on his knees...the lower limbs are bare and the phallus seemingly exposed...crowning his head is a pair of horns meeting in a tall head-dress. To either side of the God are four animals, an elephant and tiger on his proper right, a rhinoceros and buffalo on his left. Beneath the throne are two deer standing with heads regardant and horns turned to the center...*[12]" – as the direct precursor of the classical Śiva. Under the mesmerism of the Aryan Invasion theory the Indus Valley religion is looked upon as a proto-Dravidian Śiva religion that promoted the worship of the 'anthropomorphic ithyphallic' god as well as of the separate Phallus symbol. In the light of the increasing evidences that tend to discard the Aryan Invasion theory, a better proposition may be to look for a theatre appropriate for the co-existence of the two indigenous but different streams of Tantra and the Veda within the Indian subcontinent.

11. On Phallus Worship

The following account by Dandekar may help us in understanding the historical context of Phallus worship:

"*RGB's treatment of phallus-worship is rather inadequate. And this is quite understandable, for, he did not have before him the considerable archaeological material, which has become available in recent times. The tradition of Phallus worship in India is, indeed, very ancient. It has been suggested that the Neolithic people in South India were primarily worshippers of liṅga. Evidence is produced in this connection of the Kapagallu hill in Bellary district, where one sees a liṅga together with a bull in a crouching position. Be that as it may, there is certainly far more definite and far more profuse evidence regarding phallus-worship, which has been unearthed in the Indus valley. The conical terracotta objects with rounded tops and the ring-stones discovered in the Indus Valley are, without doubt, the symbols of liṅga and yōni respectively....*

It is not unlikely that the worship of the Phallus, which as evidenced by its almost

[12] Marshall, quoted by R.N.Dandekar, Insights Into Hinduism. Description of Śiva available in Mahābhārata has striking resemblance to the portrayal on the seal. Śāntiparva, 284:69 to 180 contains the praise of Śiva by Dakṣa, which describe Śiva as Paśupati, Trijaṭā, Triśīrṣa, Triśūlapāṇi, Trinetra, Trayaṃbaka, Nāgarāja etc. Likewise in Anuśāsanaparva chapters 14 and 17 we can find Śiva as Dikvāsas, Ūrdhva liṅga, Yogeśvara, Yogādhyakṣa, Śārdūlarūpa, Vyāḷarūpa, Vyāghrājina, Mṛgabāṇārpaṇa, Mahiṣaghna, Gaṇḍalin etc.

universal dissemination, must have been a natural development in the history of human culture, had grown in India independently in the hoary past and that it came to be associated with the religion of the ithyphallic god only at some later date....

As phallus worship was supposed to have been unknown to the Veda, it was suggested that it had originated among the Dravidian races or among the Western nations and even among the Greeks. For one thing, it is not correct to say that phallus-worship was unknown to the Vedic poet-priests; indeed they knew it and abhorred it as is indicated by their attitude towards the Śiśnadevas. And, secondly, in view of its universal diffusion in very ancient times, the question regarding its origin is rendered almost irrelevant".

We find in the Mahābhārata a very clear mention of the supremacy of Liṅga worship at:

Anuśāsana Parva: 14:232 – 235[13]:

Yasya brahmā ca Viṣṇuśca tvaṃ cāpi saha daivataiḥ I
Arcayadhvaṃ sadā liṅgaṃ tasmācchesṭḥatamō hi sah II

"Brahmā, Viṣṇu and all other gods have been worshipping Śivaliṅga always and obviously he is the greatest of all gods".

Na padmāṅkā, na cakrāṅkā, na vajrāṅkā yataḥ prajāḥ I
Liṅgāṅkā ca bhagāṅkā ca tasmānmāheśvarī prajā II

"The creation is neither characterized by Lotus (the emblem of Brahmā) nor by the Cakra (the emblem of Viṣṇu) nor by the Vajra (the emblem of Indra). But they are characterized by the Liṅga and by the Yōni (emblems of Śiva). Therefore all creations are born of Maheśvara".

Devyāḥ kāraṇarūpabhāvajanitāḥ sarvā bhagāṅkāḥ striyō I
Liṅgenāpi harasya sarvapuruṣāḥ pratyakṣacinhīkṛtāḥ II

Yō'nyatkāraṇamīśvarāt pravadate devyā ca yannāṅkitaṃ I
Trilōkye sacarācare sa tu pumān bāhyō bhaved durmatiḥ II

"All females are manifestation of the Devi and are therefore adorned with the yōni and males likewise are adorned with the mark Liṅga of Śiva – evident to all. If anyone credits any creation to any other cause and is devoid of the signifying mark, he is fit to be thrown out of the three worlds".

Pulliṅgaṃ sarvamīśānaṃ Strīliṅgaṃ viddhi capyumāṃ I
Dvābhyāṃ tanubhyāṃ vyāptaṃ hi carācaramidaṃ jagat II 235 II

"Know Īśāna to be the male organ and Umā to be the female one. All this world is a manifestation of these two organs".

[13] Mahābhārata, Gita Press Edition, 1981.

It is well evident from the above accounts that the worship of Śiva vis-à-vis Tāntrik Mahākāla or Time as Phallus certainly has an antiquity comparable to the Vedas and perhaps even more. Not only the modern but also the medieval and epic Hindu religion stemmed from a Tāntrik past rather than exclusively Vedic as is made out to be by certain class of scholarship. This is true about the origins of astronomy and astrology also – they are by-products of the Tāntric pursuance of Yoga and mukti or the Serpent power Kuṇḍalini seated on the Mūlādhāra of both the cosmic and the terrestrial beings.

12. Worship of the Serpent

Worship of the serpent too scholars have credited to Man's fear of the Cobra that caused instant death. Nothing may be more absurd than this explanation evolving from sociology, psychology and commonsense. The serpent worshipped is Kālasarpa, the Serpent of Time made up of the Nodes of Moon, Rāhu and Śikhi. As is the case with Phallus worship, the Nāga cult is also universal and the scholars have considered the two practices are different – as being practiced by different cults. Scholars have equated the Nāga cults with the present day Nāga tribes of North East India, Nāgaland which form a culturally backward area. On the other hand Nāgas have been associated with places such as Takṣaśila and South India, which were places of cultural advancement since time immemorial. May be it is that originally the worship of snake began as an aboriginal custom as we see in tribal areas but it was replaced subsequently in places such as Takṣaśila and Malabar where the Tāntric cults prevailed with the worship of Nāgarāja as the symbol of Time. Iyengar has descrbed Malabār as the South Indian headquarters of the Nāgas, courtesy the Nayars – who form the most ardent devotees of the Serpent God. A discussion on Serpent Worship shall remain incomplete without a detailed reference to the custom of Nayars, who worship the Sarpa in the Tāntric mode.

Nayars and the Sarpa – Serpent Worship in Malabar[14]

The relevant part is reproduced below:

"Malabar is a country which preserves to this day primitive institutions of a type peculiarly fascinating to the ethnologist. Of the various kinds of primitive worship still practiced in the country that of the serpent occupies a prominent place. Here the serpent is deified and offerings of pūjā are often made to the reptile. It has got a powerful hold over popular imagination. Each household has got its own serpent deity possessing large powers for as well as for evil. A separate spot is set apart in the house-compound as the abode of these deities. This reserved spot is converted into a small jungle almost circular in shape. It is overgrown with trees of various kinds, and shrubs and some times medicinal plants also. In the middle of this quasi-circular shrine images usually made of laterite after specified shapes are arranged...No trees from the place are to be felled down, nor any plant whatever for that matter with any metal or more particularly iron weapons...".

Also the 'Report of the Census of Travancore – 1891' gives the following account:

"A serpent-kavoo (kāvu) in Travancore. Many places of Hindu worship exist in Travancore

[14] Reference: 'Malabar and its Folk', T.K.G.Paniker, Natesan & Co. Madras.

under groves locally known as kavoos. There are thousands of these in the country. Lieutenants Ward and Conner estimated their number at 15,000 seventy years ago.... One of these a well-known sarpa-kavoo in a village 70 miles north of Travancore will be here described. Mythological origin for these sarpa-kavoos is thus stated in Keraḷōtpatti. When Paraśurāma's first colonists found Kerala uninhabitable and un-improvable, they abandoned it and returned to their old country. During the time of their absence the Nāgas (serpents) of the lower world, called in popular language Nāgalōkaṃ or Pātāḷa, took possession of the newly reclaimed land and settled there. The colonists returning found that the serpents had unsurped their lands, upon which a fight ensued, and Paraśurāma arbitrated between his colonists and the Nāgas, with the result that these latter were to be given a corner of every occupied compound. Thus arose the sarpa-kavoos of Malabar, which, as I have already described in a previous chapter, is generally at the southwest corner of every Taravāḍ garden. And Paraśurāma further ordained that the places allotted to the Nāgas were to be left untouched by the knife or the spade, thus enabling the underwood trees and creepers to grow luxuriantly therein. It is to such places that the name of Kāvu [or grove] is given. In the Kāvu are basement called Citrakūṭaṃ and sometimes a small wall is thrown round to prevent cattle or children trespassing into that space. The propitiation of the serpent is deemed essential for the well-being and prosperity of the householder. Offerings of nūruṃ pāluṃ [dough and milk], of cooked rice, lights and songs are made periodically to the serpent gods...".

These accounts provide the essential features of Serpent worship apparent to an external observer – it is nothing more than feeding the Cobra or propitiating it outwardly but the real facts are different. The most famous of the Serpent or Nāgarāja shrine in Kerala is Maṇṇāraśāla, where the deity worshipped is in fact Nāga-veṣṭita Liṅga or the Phallus adorned with the Serpent, which are none other than the symbols of Mūla nakṣatra and the nodes of moon Rāhu & Śikhi. Both are thus the personifications of time conceived as Mūlādhāra Rāhu-Śikhi Cakra. The Tāntric conception of the Serpent is further apparent in the description of Kuṇḍalini as a Sarpa, which remains coiled in the Mūlādhāraṃ.

The major festival days of the temple are of Āyilyaṃ nakṣatra – the famed constellation of the Nāgas occupying $106^{0}40'$ to 120^{0} of the Rāśicakra. Śivarātri and pañcami tithi are also considered important. Āyilyaṃ also receives the appellation Kārkōṭaka in mythology, who is supposed to have merged with Śiva in the Mahākāla-vana. The assimilation of the Śiva and the Nāga cults can also be inferred from Varāhapurāṇa [215:73-74], which states that at a place called Mūlakṣetra, the serpent Vāsuki stands at the gate of Śiva along with many of his attendants[15].

Apparently, at present the custodians of the Serpent temples of Kerala are Nambūtiri Brahmins but the matrilineal succession and the dominant status of the priestess suggests the temples as remnants of the Nāyar worship of the Serpents / Tāntrik tradition. According to Iyengar, Nambūtiris were the Nāgas or Nāyars who first subscribed to the Vedic cult introduced by Paraśurāma in Kerala and as such it is likely that the custodians of serpent temples may be the Nāyar converts to the Vaidika tradition who have not forsaken their Serpent gods.

[15] Quoted by Dange, S.A., in Encyclopedia of Purāṇic Beliefs and Practices, p.1269

What is important to note in the above discussion is: the Serpent worship in fact is the worship of Śiva himself, and the reptile is only an accidental/mistaken identity or symbolic representative of the Tāntrik serpent viz., the serpent of time. Vāsuki standing guard at Mūlakṣetra can't find a better illustration other than the Nāgaveṣṭita Liṅga worshipped as the Serpent at Maṇṇāraśāla [Serpent is also considered as the Yajñōpavīta of Śiva].

13. Tāntrik versus Astronomical Tradition in Kerala

Kerala, the tiny tract of land lying sandwiched between the Western Ghats and the Arabian Sea, has kept alive a distinct astronomical tradition since immemorial times. Earliest of the available remnants of this tradition are the Candravākyas – "gīrṇaśreyādi" - of Vararuci belonging to the fourth century AD. Among Vararuci's 12 legendary sons, the eldest, Meḷattōḷ Agnihotri is believed to have born on 18th February 343 AD, corresponding to the Kali-chronogram of 1257921. Meḷattōḷ Agnihotri is also regarded as the Vaidikā preceptor who kindled Yajñāgni for the first time in Kerala on 14th February 378 AD corresponding to the Kali-chronogram of "Yajñasthānaṃ saṃrakṣyaṃ" [=1270701]. This is supportive of the belief that Vararuci belonged to the 4th century AD. Vākyakaraṇa, which have come to be regarded, as a work of Sundararāja is probably a 12th century redaction of the original work of Vararuci as is evident from the use of gīrṇaśreyādi Vākyas for the computation of Moon. The theory and method of Vākyagaṇitaṃ is essentially the same for Kujādi pañcagrahas and the moon and as such it may not be correct to deny the claim of Vararuci for being the original composer of Vākyakaraṇa. Apart from the underlying astronomical theory the technique derives its elegance from the ingenious use of the Kaṭapayādi notation to represent the cumulative longitudinal arcs of the planets. As may be gleaned from the process, the technique, which relied upon the "horizon phenomena" had its origin and evolution before the advent of the theory of the epicycles, that is, before the revolution spearheaded by Āryabhaṭa in the 6th century AD. Whether Āryabhaṭa was a native of Kerala cannot be answered with certainty in the absence of direct evidences. But the Kerala tradition of Āryabhaṭan astronomy vouchsafe the fact that it was Kerala that offered the richest soil for the science of Āryabhaṭa to take its roots deep into the lives of its people and society. This unique distinction cannot be the contribution of Kerala's geographical placement in the remote southwest, much farther away from ancient India's famous seats of learning such as Takṣaśila and Kusumapura. Despite this geographical disadvantage, the Āryabhaṭan School had its bloom in Kerala in the centuries that followed Āryabhaṭa due to reasons that hitherto remained obscure.

The fact that the astronomy of Vākyakaraṇa and the computation of moon using gīrṇaśreyādi vākyas rested solely upon the methods and parameters presently known as Babylonian suggests the possibility of astronomical development in Kerala much before the time of Āryabhaṭa. Prevalence of Mūlādhāra Cakra in Babylon during the Seleucid Era and the original Siddhāntic epoch at which Caitra śukḷa (1) marked the beginning of year viz., AD 231, are indicative of the development of Siddhāntic astronomy as a result of the cultural exchanges between Babylon and India. Further similarities include the worship of the phallus, bull, mother goddess and serpent, astrological development, Tāntric practices etc., in both Kerala as well as Babylon. When examined against the background of these factors the ancient trade connections between Middle East and Kerala assumes great significance.

The Cera rule – a golden period – of Kerala's history is generally reckoned as from 9^{th} to 1^{st} century BC. This period is marked by trade connections with Middle East and great prosperity owing to the favorable balance of trade. These trade relations had a beginning as early as in 3000 BC when the traders from Assyria and Babylon visited Kerala. Greeks and Romans too have been in Kerala since very early times and Solomon's ship is believed to have arrived on the Kerala coast in 1000 BC. Musiris or present day Koduṅgallūr had been the major port of the then Tamil country to which Malabar formed a part. Iyengar[16] has described in detail the references to Malabar in Periplus, details of the Roman colony in Madurai etc and also about Ptolemy's account of south India in his work on geography. When viewed against this background of Mesopotamian contacts it is not unlikely that a school of astronomy could have developed in Kerala since very early times. According to tradition the Āryabhaṭīya gaṇitaṃ was replaced in Kerala with Parahita ganitaṃ at the Mamāṅkaṃ session of AD 683 i.e., within hundred years of its promulgation by Āryabhaṭa. This extra-ordinary achievement would have been impossible in the absence of a well-developed native school of astronomy in Kerala. Moreover according to available records the first observatory in India was established at Mahōdayapuraṃ - the famed port of Musiris on the coast of Periyār – where a solar eclipse was observed by the Kerala astronomer Śaṅkaranārayaṇa in the year AD 866 (17^{th} June) corresponding to the Kalidina of 14,49,066. Āryabhaṭīya - manifested in Kusumapura - alone could not have played so much of wonder in the development of astronomy in Kerala. Native development of astronomy and astrology as we see in Mesopotamia can therefore be supposed to have existed in Kerala in the pre-Āryabhaṭa period.

14. Jyotiṣa, Mantra and Tantra

Like astronomy, astrology too is believed to have originated among the Chaldean occupants of Mesopotamia. Astrological literature renders no explicit clues as regards the locale of origin and development and the linguistic evidence often quoted of Greek terms at the best only suggest a mutual give and take between the two communities some time after the time of Ptolemy. In contrast the origin of Zodiac among the Tāntric cults stands confirmed by the evidence of Mūlādhāra Rāhu-Śikhi Cakra and the astrological symbolism too suggests the same point of origin. Purāṇic allegories in fact suggest a common origin to Tantra and Jyotiṣa / Zodiac as may be understood from the Dakṣayajṅabhaṅga episode. Yajṅa was destroyed to pave the way for Yoga and Dakṣa – the Ecliptic – was given a new head of Meṣa or Ram to abstract the zodiac from the ecliptic. Satī sacrificed herself in the Yajṅāgi and Śiva had his Tāṇḍava-nṛtya carrying her burnt body for a long spell of time at the end of which Cakravartin Viṣṇu (Sun) had the body cut into pieces by the Cakra and those pieces became the 51 mantrākṣaras. These 51 akṣaras have also been described as arising out of the Kuṇḍalinī in Tantra. Nādabrahmaṃ or Praṇavaṃ (primordial sound) exists as the Mahākuṇḍalinī, which manifests by its very nature successively into the Pañcabhūtas and ultimately reaches a static equilibrium often described as 'suṣupti' or 'yōganidra' in Pṛthvī, the fifth element. As we have already discussed, evolutionary process today has at its peak Man born out of the Pañcabhūtas as other entities of biosphere but having the special possession and

[16] History of the Tamils, AES, New Delhi, 1983 (reprint)

distinction of a dormant creative power in Him – a microcosmic manifestation of the Mahākuṇḍalinī as Jīvakuṇḍalinī. In other words evolution has placed inside Man a seed of occult power at the very bottom of his cerebro-spinal axis and its most common and the very ordinary manifestation has been the development of linguistic abilities in him. According to Tantra this is the development that conferred upon Man a " bio – cosmic " existence (rather than an exclusively biological existence of other creatures) the beginning of which is marked by the first cry of a child that brings forth a unique concert between the Jīvakuṇḍalinī and Mahākuṇḍalinī through the medium of sound communicated through the third wheel viz., the Viśśuddhi Cakra. This concert normally is only a little murmur of the dormant Kuṇḍalinī and remains unnoticeable but the process being two-way the Kuṇḍalinī can be brought into an awakening by appropriate use of the Akṣara-brahmaṃ and this is the basic principle of Mantra-yōga. It is solely because of the fact that the 'sound' is a manifestation of Kuṇḍalinī that it can be used to awaken Kuṇḍalinī at all and this is one of the fundamental principles of Tantra and may be evidenced by the fact that the onset of puberty causes changes in voice indicating that the genitals (Mūlādhāraṃ) wherein the Kuṇḍalinī is seated and the larynx (Viśsuddhi) out of which the sound is created are in some morphological communion as is being postulated in Tantra.

It is apparent from the above that the evolution of the 51-alphabets had been a crucial stage in the development of both Jyotiṣa and Tantra. But generally the language of 51-alphabets is looked upon as the language of the Vedas originated sometime after 1500 BC that came to be known as Sanskrit in later times. This popular belief cannot be reconciled with a conception of the origin of the 51-akṣaras, Tantra and Jyotiṣa in the remote antiquity of 4137 BC or even much earlier. We have already seen many instances in which the Purāṇic allegories have yielded valuable historical information and as such it may not be prudential to ignore the "prehistorical origin of the 51-alphabets" alluded to in the mythological episode of Dakṣayajñabhaṅga. If suppose we agree on the conjecture that the Vedic language had its origin and development since 1500 or 2000 BC, the only alternative to reconcile a prehistoric origin of 51-akṣaras is to look for a precursor to the Vedic language in the older Tāntric tradition. We are then naturally inclined to look at Tamil, but the present author is incompetent to draw any inferences on this aspect as the Tamil antiquity is more shrouded in mystery than the Vedic. One of the works[17] I have seen on the mystic aspect of Tamil alphabets trace their origin to Śiva and Agastya and the letters have been given Tāntric classification into five classes corresponding to the Pañcabhūtas – Ākāśa, Agni, Pṛthvī, Jala and Vāyu – which in their permutations and combinations make the words just as the terrestrial world is born of the five elements. The account given of Tamil grammar based on Tolkāppiuṃ (400 BC) is reflective of a Tāntric origin of the akṣaras, both the sounds as well as the script. As for example the Tamil Praṇava (Ōṃ) is depicted as the outline of a yogic posture (Dakṣiṇāmūrthy) or an embryonic child and also as the outline of the human brain connected to the Merudaṇḍa while the meaning of the various alphabets are explained as per their role in mantra-yōga.

By the above mention I do not mean an antiquity of 4000 BC for Tamil – I am ill equipped to make such a claim. But I am convinced that the alphabets of Sanskrit and Tamil have

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17 Naicker, PVM, 'The Tamil Alphabet and its Mystic Alphabet', AES, New Delhi, 1985

their origin in prehistoric times under the Tāntric paradigm of thinking. Under no other paradigms of thinking known was there any need for a scientifically conceived language as in Tantra wherein the whole philosophy is founded on the mantrākṣaras. When we think of the comparative antiquity of the Vedic and Tāntric traditions we must stop for a moment and ask ourselves a very pertinent question as to what inspired the Vedic Ṛṣis to attach so much importance to the syllable structure of the hymns? Even in a scholar who had been the most critical of all the so-called glories of Vedic Past, Vedas could inspire admiration for its linguistic merits as evidenced by the following words:

"*The very composition of the Ṛgveda – embodying as it does 1,028 songs or hymns by pre-literate pastoral peoples – is itself a wonder of wonders. No less a wonder is the preservation of it by retentive memory. The literary merit of this vast literature is discussed by others and falls outside the scope of our discussion. What is within the scope of our discussion – and without which no history of science in India can be adequate – is the technique developed for its preservation in memory, with meticulous care for rightly pronouncing each syllable in the vast literature, the understanding of the metre in which each hymn is composed, the grammatical syntax of their composition, their exact meaning and so on...*" [18]

"*Memorizing the Ṛgveda Saṃhitā was not an easy task, it being a very long compilation running into 1,53,826 number of words. Such a long composition if unwritten would change drastically within a dozen generations... This did not happen and a meticulously fixed text of the Ṛgveda Saṃhitā was transmitted through many many generations. Oral transmission was meticulous enough to the extent of preserving each and every syllable as if the syllables have been imprinted on immutable rocks... Besides developing and cultivating skill of memorizing, fixing of text requires method of fixing sounds so that sounds do not get altered change with time. This can only be done if sounds are objectively defined, say, with help of detailed pronouncement procedures. In fact, a whole body of knowledge of the physiology of sound production was developed in Śṛuti phase to safeguard against phonemic slippage and contamination. Similarly fixing of long text requires fixing word order of hymns. This requires designing method that can check whether word-order has been disturbed or not...*" [19]

When we look for sufficient reasons that might have inspired such gigantic intellectual accomplishments in prehistoric antiquity, we are led only to Tantra as the source out of which the Vedic language evolved. The role of 51-alphabets is more fundamental and physical in Tantra than in the Vedas where it is only a medium of expression for the Seers.

15. Tāntric Anatomy and Astronomy

Comprehending Tāntric anatomy and the terminology is very much akin to the situation that we see in modern physics where fictitious terms such as up-quarks, down-quarks

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18 Chattopadhyaya, D., History of Science and Technology in Ancient India – The Beginnings, p.405, Firma KLM, Calcutta – 12.

[19] Navjyoti Singh, Ibid. Pp.414 - 415

and strings are under use to represent the components of fundamental particles. We can understand electron and proton, as negative and positive charges but if we are asked as to find a string or wave within an atom it will be a difficult task. Has anybody found a string within an atom so far? The answer is no! But still the scientists have reasons to believe in strings and it is strings that constitutes the latest 'theory of everything', the super-string theory. The situation may be better understood from the wave-particle duality – to quote Brian Greene:[20]

"The photoelectric effect shows that light has particle properties. The double-slit experiment shows that light manifests the interference properties of waves. Together they show that light has both wave-like and particle-like properties. The microscopic world demands that we shed our intuition that something is either a wave or a particle and embrace the possibility that it is both. It is here that Feynman's pronouncement that "nobody understands quantum mechanics" comes to the fore. We can utter words such as "wave-particle duality". We can translate these words into a mathematical formalism that describes real-world experiments with amazing accuracy. But it is extremely hard to understand at a deep, intuitive level this dazzling feature of the microscopic world".

Similar is the situation in Tantra which describe the Cerebro-Spinal Tāntric physical frame in terms of Ṣaḍcakras or six wheels (of mystery as the string) viz.,

Cakra	Spokes	Akṣaras	Bhūta	Yōni	Planet
Mūlādhāraṃ	4	va, śa, ṣa, sa	Pṛthvī	Nāga	Moon
Svādhiṣṭhānaṃ	6	ba to la	Jalaṃ	Makara	Mercury
Maṇipūraṃ	10	ḍa to pha	Agni	Meṣa	Venus
Anāhataṃ	12	ka to ṭha	Vāyu	Mṛga	Sun
Viśudhi	16	16 vowels	Ākāśa	Nāga	Mars
Ājñā	2	ha, kṣa	-	-	Jupiter
Sahasṛāra	1000	-	-	-	Saturn

These Cakras can be experienced only by a Sādhaka – the Tāntric experimenter in quest of the supreme energy, the three-fold Kuṇḍalinī or Tripurasundari. Apart from these esoteric Cakras Tantra postulates the triplet of 'nādis', Idā, Piṅgaḷā and Suṣumna, which interconnect the three wheels and extends from the bottom of the vertebral column to the cerebral cortex. Suṣumna can rightly be described as the central or super 'string' over which are coiled the solar and lunar strings Piṅgaḷā and Iḍā in spiral fashion and the triplet extends from the Mūlādhāraṃ to the Ājñā Cakra. Detailed description of these wheels is found in all standard works of Tantra and falls outside the scope of our discussion. What is of interest to us is only the astronomical content explicit or implicit in the esoteric portrayal of the Tāntric body that rarely meets with an exposition in the commonly available Tāntric literature.

O.M. Hinze[21] has discussed the astronomy underlying the 6-Wheels vis-à-vis their

[20] Brian Greene, The Elegant Universe, p.101.
[21] Hinze, O.M., Tantra Vidyā, MLB, New Delhi.

number of spokes based on the similar conceptions of Mitra-cult wherein the six esoteric centers of the body respectively belong to the planets Moon, Mercury, Venus, Sun, Mars, Jupiter and Saturn. This planetary association available in the ancient conception of Mitra-cult enables us to inquire into the rationale of the number of spokes ascribed to each wheel.

→The four spokes of Mūlādhāraṃ can be explained as representing the four quarters of luni-solar phenomena New Moon, Full Moon, First Quarter and Last Quarter which may be imagined as forming the corners of a square or the quarters of a circle.

→ Six spokes of Svādhiṣṭānaṃ represent the pattern of two interlaced triangles traced out by the positions of heliacal risings of Mercury.

→ Heliacal risings of Venus as morning and evening star generate a pattern of two overlapping pentagons, which form the ten spokes of Maṇipūraṃ. As noted by Hinze the distribution of the corners of pentagram in the Zodiac follows a " 3+2 " pattern of two corners in the male signs of Agni and Vāyu and the rest in female signs of Pṛthvī and Jala or vice versa. Allocation of alphabets reflect the above pattern – the unitary group of five dentals ta, tha, da, dha, na representing the pentagon and the remaining three cerebrals ḍa, ṭha, ṇa and two labials pa, pha representing the 3+2 pattern of distribution of corners in signs.

→ Anāhata has twelve spokes representing the twelve lunar cycles i.e. 12 new moon and full moon, in which eclipses may occur in either of the following patterns:

2 solar and 2 lunar
5 solar and 2 lunar
4 solar and 3 lunar
3 solar and 4 lunar
2 solar and 5 lunar

The maximum possible eclipse of either kind is thus 5 and minimum 2 and this probably led to the alphabet pattern we see in Anāhata of 5 gutturals (ka, kha, ga, gha, ňa), 5 palatals (ca,cha,ja,,jha, ńa) and two cerebrals (ṭa, ṭha), i.e. 5+5+2 = 12.

→ 16 – spokes of Viśuddha represents the 16 years in which Mars completes 8 cycles of the synodic phenomena including the retrogression distributed over the 12 signs of the zodiac. Alphabetic pattern ascribed is therefore 16 vowels appearing in two pairs.

→ Ãjńa Cakra presided over by Jupiter is modeled with two spokes and alphabets - the number probably is the balance of 51 – 48 – 1 = 2 where 1represented the Sahasṛāra Cakra.

→ Sahasṛāra Cakra is modeled as of 1000 spokes and it contains all the 51alphabets. Hinze has explained this conception as representing the Jupiter-Saturn revolutions, which form 51 conjunctions in 1000 years, the period that marks a precession of one nakṣatra.

This astronomical explanation of the esoteric wheels of Tantra also point towards a common origin of Jyotiṣa and Yoga proposed earlier.

The principle of symbolic equivalence between the microcosm and macrocosm, we can find reflected in the synonymous descriptions of the manifestation of the Kuṇḍalinī from Śakti and the cosmological evolution. Hinze has described the evolution of Kuṇḍalinī in the following words:

"Śiva is described as the unchangeable static aspect of the great consciousness while Śakti represents the dynamic, active side of the same consciousness. It is Śakti who has created the five elements (Mahābhūtas) from the finest (Ākāśa) to the grossest (Pṛthvī). The gradual condensation of the primordial substance (Prakṛti) implies, from the point of creating Śakti, a step-wise cramping, a growing renunciation with regard to fully unfolded "Being". When the earth element is created, Śakti has sacrificed her to the maximum limit; she cannot do more; with this her creative power has reached the end. In her last emanation, the earth element, she lies rolled together and sleeps. This aspect of Śakti is the Kuṇḍalini".

We meet with almost the same description when modern science speaks of Big bang. Universe started out with a singularity of infinitely hot and dense state and is expanding ever since. Through different stages of cramping energy descended into different forms – quarks, electrons, protons, nuclei, atoms, galaxies, stars, planets and then the biological line and ultimately man in the grip of Māyā. Man's return from the state of Nirvikalpa samādhi too traces very similar steps in the descent of Kuṇḍalinī through the Ṣaḍcakras to reach the state of sleep of Kuṇḍalinī.

Tāntric Symbolism as the Basis of Astrology

• Synonymous Phraseology of Jyotiṣa and Tantra

→ Kuṇḍalinī means both the horoscope and the Tāntric power

→ Mūla is the "ādhāraṃ" of Kuṇḍalini in both Jyotiṣa as well as Yoga

→ Both Jyotiṣa and Tantra are based on the equivalence of Piṇḍāṇḍaṃ and Brāhmāṇḍaṃ (microcosm and macrocosm)

→ Common terminology includes: Idā, Piṅgalā, Nādi, Sun, Moon, Yoga, Bhōga, Bhukti, Meru, and Cakra etc.

• Classification of Rāśis

and Mūlādhāraṃ. In the picture given 1, 2, 3...marks the respective signs Meṣa, Vṛṣabha, Mithuna etc., and the left boarder line of Rāśis 1 & 8 connecting the longitudes or positions of 0^0 and 240^0 is the Merudaṇḍa or Mukti rekha over which the Kuṇḍalini ascends. The path of the Kuṇḍalini is via signs 8, 7, 6, 5, 4, 3, 2, 1 to reach the Śīrṣa at 0^0 covering 18 nakṣatras of 13^0.333 each which represented the 18 steps of Yogavidya. Further, 40^0 of longitude constitutes one navāmśa cakra [40^0 * 9 = 360^0] and as such the Kuṇḍalini sector is made up of six navāmśa cakras which are representative of the Ṣadcakras.

12	1	2	3
11	Rāśi		4
10			5
9	8	7	6

Further the twelve signs are classified on the basis of the Triguṇas and Caturbhūtas as shown below:

Rāśis	Tattva/ Bhūta	Guṇa
Meṣa	Agni	Tamas
Vṛṣabha	Pṛthvī	Rajas
Mithuna	Vāyu	Sattva
Kaṭaka	Jala	Tama
Siṃha	Agni	Rajas
Kanyā	Pṛthvī	Sattva
Tulā	Vāyu	Tama
Vṛścikā	Jala	Rajas
Dhanu	Agni	Sattva
Makara	Pṛthvī	Tama
Kuṃbha	Vāyu	Rajas
Mīnā	Jala	Sattva

These basic attributes of Rāśis form the foundation over which astrological symbolism is built up. The planetary lordship over signs was also decided on the basis of Tāntric esoteric wisdom. The eight houses from Meṣa onwards up to Vṛścikā is ruled by planets Mars, Venus, Mercury, Moon and Sun and forms the esoteric frame of Kālapuruṣa, which manifest terrestrially as the power of delusion (Māyā) inherent in Time. Rāśis 9^{th} to 12^{th} ruled by Jupiter and Saturn represent things that are independent of Māyā viz., Jñāna and Karma that are contributive of liberation from the delusive spirit.

Similarly, classification of the nakṣatras is three fold in direct synchronism with the three-fold Kuṇḍalinī that splits into Triguṇas, which we find personified in mythology as Trimūrtis. [22]

[22] Magical diagrams, referred to as Yantras too have the origin of their geometry traceable to planetary revolutions over the zodiac. The most magnificent of occult symbols, Śrī Cakra in fact is an occult portrayal of the mystery of life using an ingeniously conceived astronomical script as is evident from the description of

16. Secret of Kuṇḍalinī

• Controversy of definition of birth

In the very beginning of the astrological process of divination we encounter an unsolvable controversy as to what actually is the precise definition of birth?

→ Is it 'the appearance of Head' or 'the first touch of ground' or 'the first cry' or 'the cutting of umbilical chord'?

The recorded time obviously has a component of confusion attached to it howsoever we may care for accuracy in noting either of the above movements or even all of them. Classical texts do prescribe certain methods for rectification of birth time but neither of them is consistent and reliable. In fact rather than time, we are more bothered about the longitude of lagna as diurnal rotation of the earth alters the value by 15 minutes of arc in one minute of time. i.e. Lagna can be accurate up to the minutes, only if we can assure the accuracy of birth time up to seconds. This is an almost impossible task.

→ If Lagna cannot be fixed up to the minutes of arc with certainty confusion shall obviously spread to the divisional charts. In many Vargas we may fail to have the correct Lagna and astrology shall be reduced to a bundle of confusion. Further, according to Satyācārya the daśas have to be derived from the stronger of the two factors viz., Lagna & Moon. *Despite such importance of the birth time and accurate Lagna, astrological wisdom of the post – Varāhamihira period is not explicit as to what exactly is the astrological definition of birth time. What precisely is the birth time is a question as confusing as the controversy of ayanāmśa or zodiac itself.*

The reason for this silence is that the astrological wisdom was a part of the occult knowledge of the Tāntrics and as such many of the top secrets of the discipline were available only to the initiates and therefore with the degeneration of the cults such knowledge was lost for the posterity. Occult science got reduced to a pseudo science and it has remained so during the last two thousand years.

• Tāntric Definition of Birth Time

Tantra has no confusion as to the precise definition of birth time. A Tāntric or astrological birth is marked by the first cry of the child with which the 'new being' reports to the 'eternal being' Mahākāla. More than giving a precise definition, Tantra profess a mathematically conceivable pattern of destiny operating over the terrestrial existence based on the longitude of Moon as well as the ascendant or Lagna.

• Pāda or Kunda Lagna

Pāda or Kunda here in refers to 81 in 'Kaṭapayādi' notation. According to classical instructions 81 times the Lagna must fall in either of the trikōṇa rāśis of the Moon

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Devi's effulgence seated in Śrī Cakra as constituted by the 360 rays – divided among Agni, Sun and Moon in the ratio 118:106:136 – which enlighten the macrocosm as well as microcosm and give rise to the calculation of time, Sun for the day, Moon for the month and Agni for the ṛtus or seasons.

provided the Lagna is reasonably correct. This relationship can be modified mathematically to fix the point ascendant –in fact the above technique arose out of the Tāntric definition of birth and the mathematical pattern of destiny under the rule:

$$\text{Lagna} \times 81 \text{ (Kunda Lagna)} = \text{Longitude of Moon} \pm 120^0 \text{ or } 0^0$$

Synchronization of Lagna and Moon implicit in the above is:

Birth in nakṣatra beginning from Aśvini will correspond to successive arcs of 9.87654321 minutes ascending on the east:

Serial No:	Arc of Lagna		Nakṣatra
	Beginning	End	
1	0^0 0'0"	9'.87654321	Aśvini
2	$0^0$9'.87654321	$0^0$19' 45".185	Bharaṇi
3	$0^0$19' 45".185	$0^0$29'37".77	Kṛttikā
	....	....	
10	$1^0$28' 53".33	$1^0$38'45".93	Maghā
	....	....	
19	2^0 57' 46".66	3^0 07'45"	Mūla
	....	....	
27	$4^0$16' 47".4	$4^0$26'40"	Revati

First cycle of Kunda Lagna ends and second begins again on Aśvini. In this manner there are a total of 81 cycles so that 81x 4^0.444 = 360^0. i.e. a particular longitude of Moon shall correspond to 1/3[rd] of the above arc of $4^0$26'.66 i.e. $1^0$28'53".33 or 88'.88 - roughly at intervals of $5^{min}56^{sec}$ in time. Alternatively, it can be said that the Tantra makes the sky to revolve 81 times faster (mathematically) and for every 9.87654321 minutes of arc of the ascendant Kunda Lagna covers one nakṣatra each and a birth manifests only when the Kunda Lagna coincides the triangular longitude of Moon. It is this mystic phenomenon that necessitated the division of the ecliptic into 27 divisions of 800' each (nakṣatras). 800/81 leads to the mystic number 9.87654320987654320987...on which the whole of astrological wisdom is founded.

It is therefore possible to fix the point ascendant if the birth time is known with a precision of $\pm$ 3 minutes. The correction involved can be computed as either:

$$= \frac{\text{Kunda Lagna -Moon or [Moon + } 120^0]}{81} \quad \text{or}$$

$$= \frac{\text{Moon or [Moon + } 120^0] \text{ - Kunda Lagna}}{81}$$

Tāntric Theory behind the Zodiac

Mathematically Hindu Zodiac is a division of the ecliptic into 12 Rāśis of 30^0 each and 27 nakṣatras of $13^020'$ each. It is generally believed that the first of the divisions is more universal and earlier in origin than the second. The Graeco, Arabic, Babylonian as well as Hindu nomenclatures of the signs are essentially the same and this universality suggests a common source of inheritance like the ancient civilizations of Babylon, India or Egypt. The Tantra literature on these occult secrets has not survived time to reach this modern age. Such lost wisdom has to be recreated by the grace of Kundalini as has happened in many past ages.

Rudiments of 12-fold as well as more complex divisions of the ecliptic are visible in the Ṛgveda. Hymns not only imply divisions arising from 12 and its fractions like 2,3,4 and 6 but also suggest some serious efforts to comprehend the natural phenomena mathematically. But almost all the interpreters of the Ṛgvedic hymns consider the number 360 as a simple day-count and attach no mathematical significance other than primitive thinking to such counts. In the words of Dr. M.N. Saha:

"*Like other nations of antiquity early Egyptians has a year of 360 days divided into 12 months each of 30 days; but they found very early from the recurrence of the Nile flood, that the seasonal year consisted approximately of 365 days and that a month or lunation was nearly 29 1/2 days (real length 29.531 days). But they had already framed a calendar on the 30-day month and 360-day year, which had received religious sanction. Hence arose the first necessity for calendar reform recorded in ancient history....*"

Here Saha's reference is obviously to the imperfect knowledge length of the year that led to the year-frame of 360 days having 12 equal divisions. Prima-facie there is nothing wrong in this reasoning. But closer look raises a few pertinent questions:

Why should the imperfect knowledge lead to mathematical sense of perfection?

Formulation of the year took place under the guidance of the luni-solar phenomena. As such 12 lunations must have obviously ended at a count of 355 days. On the other hand, had the guidance been predominantly solar like the heliacal rising of Sirius the count would have been 365 or 366 days. In between these lunar and solar extremes, how could the primitive minds locate 360 had they been devoid of any numerical sense? Moreover 30 and 360 simultaneously became significant only with the radix of 10.

What better archaeological evidence can we get for the use of decimal/ sexagesimal system, other than the graduations of 720, 360,12 & 3 we see in the Vedic hymns?

For the sake of discussion it can be agreed that 360 is just a count of days only. But then how can we explain the evolution of the seven-day-week? A six-day week would have been more harmonious with the count of 360 and that had been the practice in Vedic India as may be understood from the works of Syāma Sāstry on Vedic Astronomy.

But as is well known the "seven-day week" is astrological in origin and the planetary lordship evolved out of the distribution of planets in their heliocentric order (Saturn,

Jupiter, Mars, Sun, Venus, Mercury, and Moon) over a division of the day in to 24 equal parts known as Hōra or hour. According to the Calendar Reform Committee Report.

"*Historical Scholarship has shown that unlike the year and month, the seven-day week is an artificial man-made cycle.... The seven-day week from the account of its origin it is clearly based on astrological ideology.... The weekdays are not found in earlier Hindu scriptures like Vedas or the classics like the great epic Mahābhārata. They occur in inscriptions only from AD 484 an unimportant part in the religious observances of the Hindus which are determined by the Moon's phases....*"

The logic at work and the inference drawn are typical of historical research - as one or two inscriptions of 300 AD haven't mentioned the weekday its non-existence is concluded. Dr. Saha himself did record in his report that the idea of counting the heap of days elapsed from a specified epoch up to the given date dawned upon the Hindu astronomers as early as in 500 AD, at the time of Āryabhaṭa. The computation of ahargaṇa is one of the cornerstones of Siddhāntic astronomy and Āryabhaṭa has not claimed any originality for the method. As such it is very clear that the method is traditional and has an antiquity that preceded Āryabhaṭa by centuries. Use of such a day count i.e. the computed Ahargaṇa for astronomical purposes required verification in terms of the weekday and it is quite unlikely that method could have evolved in the absence of the weekday.

The correlation between the seven-day week and the 24 divisions of the day has no easy explanation other than a 'piece of irrational thinking by the primitive minds'. The heliocentric planetary order could have been very well applied over the 12 divisions of a day as well. The progenitors of the concept have applied a scientific criterion – the time period relationship between planets or heliocentric order – in deciding the planetary sequence over the divisions. How can the latter half be irrational or arbitrarily chosen? Some logic must have certainly guided them. We shall revert to this aspect later.

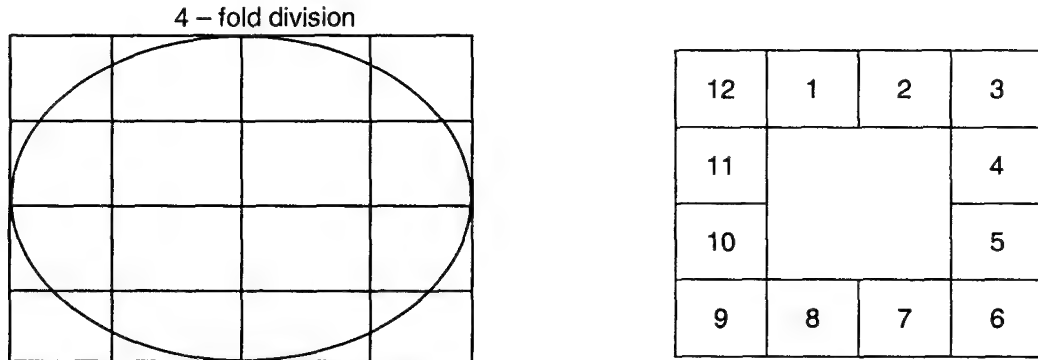
Dividing the Ecliptic into 27 Nakṣatras

Far more complicated is the situation that we encounter with the nakṣatra zodiac of 27 divisions considered as arising out of the daily lunar motion. If the divisions of ecliptic evolved simply out of aboriginal practices and convenience and the astrological formalism imaginary as well as irrational not only astrology but the Hindu religious citadel also will collapse - all that we describe as our culture and religion will become a bundle of non-sense having no scientific rationale. It is true that the 360 and 27 divisions do have a resemblance to the respective arcs covered by the Sun and Moon in a day, but what about the subtler divisions of the Zodiac? Just as we have the 12 Ādityas, Mahābhārata ascribe 108 names to the Sun and obviously this is a reflection of the popular division known as navāṃśa a mention of which is also available in the Maitrāyaṇa Upaniṣad and Nidāna sūtras. Even if we accept the most posterior date for the Mahābhārata it will be difficult to explain the entry of such astrological factors –an irrational development from 12 divisions to 27 and then 108 – into the epic in a mythological form.

Zodiac whether it is a product of human or superhuman wisdom, various divisions along with the moving longitudes represent an abstraction of the mystery of life. In other words,

astrology has credibility only if we can establish that the formalism is an expression of destiny in the language of mathematics. It is not necessary to fully comprehend the underlying phenomena or physical reality but it must be possible to identify the sequence of logic employed in the process. In science we are aware of the instances like the Mendaliyef's Periodic table or Bohr's atom model, wherein the genius was guided by sheer logic and hypothetical computations like Bohr's formula for the maximum occupancy of a shell ($2n^2$), which were reflections of more complex natural laws that guided the physical processes. Similarly whether the zodiacal divisions be empirical or mathematical, if we are able to decipher a general logic or formula employed in the process, zodiac can very well claim the status of a theoretical construct emerging out of wisdom rather than primitive imagination.

Superimposition of the Space-divisions over the elliptical orbit



The style of drawing the horoscope prevailing in South India since very early times is a Tāntric squaring of the elliptical planetary orbit. The four vertical and horizontal lines that intercept the orbit leads to a four-fold division of space in two dimensions leading to a periphery of 12 columns or houses and an inner quadrangular demarcation that depict a two-fold division. The two-fold division is a representation of the four cardinal directions N-E-W-S and in astronomy they signify the four cardinal points of the equator-ecliptic geometry viz., the equinoxes and solstices. Also this two-fold division generates the square aspect of Western astrology and the 'Kendras' of the Hindu system. The general features of this quite natural and fundamental division process can be understood by a glance over the corresponding sequence in geometry.

(1) A straight line divides the whole universe into two hemi-ellipsoids. Mathematically this is the linear dimension or a one-dimensional process.

(2) The cross signifies a plane of two dimensions, or as said above the N-E-W-S. This is one of the most popular mystic symbols.

(3) The 3×3 division leads to a periphery of 8 houses that signify in turn the 8 directions. Buddhism has a spiritual application of this division while in physics we can see Gellmann's "Eight-fold way".

(4) The 4×4 division or the Zodiac with the 3 navels as reflected in some of the Vedic hymns represent in astrology the classification of signs into 4 groups of 3 each i.e. Fire, Earth, Air and Water signs. Correspondingly in Physics it can be seen that all fundamental particles are constituted of a set of four quarks in their three modes so that 4×3 = 12 and in Genetic-code the basic configuration is of 4 acid bases in their 3 forms. Also four are the dimensions of this universe perceivable to humans through their senses. In this way physical significance of the successive divisions can be searched out.

Mathematical features of the sequence of peripheral divisions can be understood by a glance over the 3-fold, 4-fold and 5-fold divisions. It is apparent that the super imposition of these space-divisions 2x2 to 7x7 onto a curvilinear path yields the divisions 4,8,12,16,20,24,28, i.e. in general 4(n-1) division of the periphery for an n-fold division of space.

Explanation of the Zodiacal Features:

Hindu Zodiac i.e. Rāśi and its different Vargas (harmonics) are now self-evident.

Varga	N	D = 4[N-1]
Rasi	4-fold	12
Rāśix2	7-fold	24
Rāśix3	10-fold	36
Rāśix4	13-fold	48
Rāśix5	16 -fold	60
Rāśix6	19 -fold	72
Rāśix7	22 -fold	84
Rāśix8	25 –fold	96
Rāśix9	28 –fold	108
Rāśix10	31 –fold	120
Rāśix11	34 –fold	132
Rāśix12	37 –fold	144

In terms of the serial order of the harmonics(R×Z, where Z is an integer), the theory can be expressed as:

- N = (1+3Z) where Z is an integer gives the sequential order (N) of space division.

- D = 4(N-1) gives the corresponding divisions of the curvilinear path.

On combing both, we get the definition of a Varga viz., D = 12 Z where Z is an integer. Accordingly it can be seen that the 9^{th} harmonic or the navāṃśa chart correspond to the 28-fold division of space that leads to 108 navāṃśas each of extent $3^0 20'$. Four of these navāṃśas together constitute $13^0 20'$ or one nakṣatra division and hence the total number of 27 nakṣatras in 360 degrees. The 28-fold space division was perhaps wrongly construed as 28 ecliptic divisions probably in some dark age when the mathematical aspect got relegated to the background. It is evident from the theory given that these divisions have nothing to do with yogatāras except for the identification via nomenclature. It must be especially noted here that there exist no space divisions corresponding to a 27-divisional graduation of the curvilinear obit, the formula being D = 4(N -1), excludes all odd number graduations of the circular/elliptical path.

Explanation of Hora and Seven-day Work

The seven-fold division of space corresponds to and Orbital graduation of 24 and the seven-day week was commissioned accordingly. In fact no other logical explanation was ever forwarded by anyone for the correlation between the 7 days and 24 hours of a day. Distribution being in the heliocentric order Saturn, Jupiter, Mars, Sun (Earth), Venus, Mercury, Moon, after the 24 hours of a Saturday the 25^{th} hour or the next day will begin with Sun and the day therefore was Sunday.

The Hōra divisions of time emerges from the Earth's revolution about its axis and is therefore related to the successive rising points at the horizon i.e. the ascending degrees. This also explains the Varāhamihira's derivation of the term 'Hōra' from 'ahōrātra' meaning - one revolution of the Earth on its axis. Further the successively rising degrees (i.e. Lagna or Hōra) symbolize time and its lord Mahādeva therefore received the appellation Hara and the term 'Hōra' most probably arose out of this appellation or the synonymous appellation Hari of Sun/ Visnu.

Planetary Years

The daśa years credited to the planets viz., 6, 10, 7, 18, 16, 19, 17, 20 too had their origin out of the first four numerals 1, 2, 3, and 4.

Sum of the digits 1+2+3+4=10 = R was used as the radix.

Moon =10 (=R); Sun = R - 4 = 6; Mars, Śikhi = R - 3 = 7; Mercury=2 R - 3 =17; Jupiter =2 R - 4 =16; Rāhu = 2 R - 2 =18; Saturn = 2 R -1 =19; Venus = 2 R = 20.

Alternatively, R - 4 = 6, R - 3 = 7, R - 2 = 8, R - 1 = 9 and R =10 can give all daśa years by addition to 10 or 0.

Implicit Tāntric Rationales

In the theory outlined above we can't miss the notice of the four spokes of Mūlādhāra, the seat of Kuṇḍalinī. Rāśicakra in fact is the most important of all Yantras employed in Tāntric worship. It represents the most fundamental as well as the most sophisticated interrelationship between the microcosm and macrocosm and as such in its design the sum total of Tāntric wisdom must have played its role. The designs of the Ṣaḍcakras and the Śṛīcakra took shape out of the Kālacakra as the Tāntrics conceived it – Mūlādhāra Rāhu Śikhi Cakra. We can find in the astrological literature the equivalence between the Ṣaḍcakras and Ṣaḍvargas as:[23]

"Drekkāṇādikrameṇa kālapuruṣasya mūladhāradiṣaḍādhārāḥ krameṇa sūcitāḥ I Śāstrasya mantratulyatvaṃ pūrvamevaṃ pradarśitaṃ I Atō$f$syāfādhārādicintānyāyyaiva I Tathā cōktaṃ:

Mūlādhāre dṛgāṇaḥ syāt pitṛcintā ravistathā I
Svādhiṣṭāne tu horā syānmātṛcintā tathā śaśī II
Maṇipūre navāmśaśca bhrātṛcintā kujō$f$pi ca I
Anāhate ca triṃśāṃśō vāṇīcintā budhastathā II
Viśuddhou dvādaśāṃśaḥ syāt putracintā tathā guru I
Ājñāyāṃ kṣetṛamuddiṣṭaṃ jāyācintā sitastathā II
Dvādaśānte śanaiścārī nāśacintā ca kīrtitā I
Tatrasthoustadīśaiśca balābalavaśātphalaṃ II "

These verses, which may be the remnants of a bigger volume of literature, illustrate the interrelationship between Tantra and Jyotiṣa. According to these verses the planetary lordship of the Ṣaḍcakras is different from what Hinze has brought out in his work:

Mūlādhāraṃ	Sun	Drekkāṇaṃ
Svādhiṣṭhānaṃ	Moon	Hōra
Maṇipuraṃ	Mars	Navāṃśa
Anāhata	Mercury	Triṃśāṃśaṃ
Viśuddhi	Jupiter	Dvādaśāṃśa
Ājña	Venus	Rāśi

Despite the difference with the western conception the above correlation point towards the Jyotiṣa – Tantra interdependence. The terminology such as Ṣadvarga, Ṣadbala, Kunda etc and the religious significance of numbers such as 8 and 18, which represent Mūlādhāraṃ in terms of Rāśis and Nakṣatras, also suggests Tāntric influence.

Over and above the similarities in theoretical conceptions/constructs the true practice of astrology to ascertain the good and evil propensities of time depend fundamentally on the

[23] ANS Iyengar, Varāhamihira Horāśāstraṃ, pp.39 – 40.

Yōga nāḍis Iḍā of Moon and Piṅgalā of Sun, which respectively represent the breaths passing through the left and right nostrils. In the words of John Woodroffe:

"They both indicate Time or Kāla, and Suṣumna devours Kāla. For on that path entry is made into timelessness. The three are also known as Gaṅgā (Iḍā), Yamunā (Piṅgalā) and Sarasvatī (Suṣumna), after the names of the three sacred rivers of India. The Mūlādhāra is the meeting place of the three "rivers" and hence is called Yukta-triveṇī. Proceeding from the Ādhāra lotus, they alternate from right to left and left to right[24]*, thus going round the lotuses*".

A prediction made without ascertaining the 'śaraṃ' i.e. benevolence indicated by Piṅgalā or malevolence portended by Iḍā is meaningless. Jīvapuruṣa, itself is the most sophisticated Yantra and when it is properly conditioned by Yōga the Iḍā and Piṅgalā signal the quality of time or auspiciousness of the moment.

A more detailed explanation is not attempted due to constraints of time and space.

Rationale of Temple Worship

A glance at the Tāntric literature suggests in fact the real meaning of the terms such as Brahmā, Viṣnu, Rudra, Bharata, Ayodhya etc. It is quite likely that the authors of the Purāṇas and epics drew their vocabulary from the Tantric literature rather than Tantra borrowing it from the Purāṇas. In fact Purāṇas have no rationale of such terms but in Tantra they are pregnant with meanings that points towards Tāntric origin of the terminology. As for example we see in the epics and purāṇas bewildering accounts of Brahmā, Viṣnu and Rudra that defy commonsense but in Tantra we are able to find them in our own body over Svādhiṣṭhāna, Anāhata and Ājṅa with an explicit rationale. The purāṇic legend of the birth of Brahmā in the Nābhī-padma (Maṇipūraṃ) of Viṣnu is nothing but a mythological adaptation of the related Tāntric conception. Far more remarkable is the fearsome form of Kāḷī under worship, which apparently borders an aboriginal conception of violence personified in the purāṇic description. But in Tantra we find the explanation that it is the 51 akṣaras that is represented in the garland apparently of severed human heads – which represents the power of mantras withdrawn and thus – Śiva under her feet reduced to a Śava.

• What do the Idol worship and the mythological characters signify in the absence of the Āgamas? Are they simply products of primitive imagination?

• What kind of a power do the mantras used in the worship invocate? To what precise worldly location do they apply?

• What kind of a zodiac, the scriptures recommend for fixing the time of celebrations? Further, do these celebrations carry any rationale or relevance at all?

[24] Spiral motion from right to left and left to right: Probably this is an adaptation of the motion of moon relative to the ecliptic / Nodes, Rāhu and Śikhi.

• Even among the deities the Phallus (Śivaliṅga) stands out as one of the two most important ones, worshipped all over India. Does this mean that the whole custom and the galaxy of Hindu Gods are of primitive origin?

• What about the great Temple structures that we see across the length and breadth of the sub-continent- from Kanyākumārī to Badarī and Dvāraka to Puri? Are they reflective of only the absurd depths of Hindu idiosyncrasy? If not what scientific foundations do they have?

• When we are ignorant of the rationale of the Idols, what efficacy can be expected of the mantra-s chanted before the idols?

• From where do these Idols derive their occult power?

No answer is forthcoming for these questions from any corners. Blind faith is under emphasis rather than science and reason. No guidance is forthcoming from the Preceptors as to what really is the true religion?

We have placed Idols of different Gods in different fashions, in different sizes and shapes, with different materials including the marble, paper pulp as well as plastic in temples, homes, Vehicles, at almost all places that can be thought of.

• Do the Hindu śāstras prescribe or allow this kind of a proliferation of "Idol installation" with no consideration for 'space' and schedule of proper pūjas?

• Do the Hindu scriptures provide for the accommodation of all sorts of perverse thinking in the use of their 'instruments' of faith? If so, what justification is there for the Āgamas that stipulate the 'observances' in minute detail? For example we have different counts for the 'pradakshina' around different Deities and in the case of Rudra (Śiva) we find an even more strange practice that the full circle is not intended and the path returns after 2/3rd of the periphery - are such rules arbitrary in origin?

• Idol worship - Is it an art or a science? If a science, is there any room for imagination in the making of an Idol or the Temple edifice? Do the śāstras allow the construction of Temples in the same fashion as Qutub Minar or the Eiffel Tower?

For the different deities specific rules prevail for ārati, specific offerings have been recommended, specific flowers have been assigned for Pūja and even specific colors have been stipulated for the garments etc. Under such a circumstance do any body has the license to break these codes?

None of the other religions except the Hindus allow the adulteration of the fundamental conceptions out of which the faith derives its sanctity. With the Hindus, neither the society nor the Ācāryas are aware of the source of sanctity of their religion or Dharma and for ages it is under unchecked degeneration. The prevailing situation of ignorance lethargy and pseudo-spirituality calls for an appropriate challenge to the authorities and Ācaryas

concerned to stand up and answer these questions of vital importance to the Hindu way of life.

No answer can be found for the above questions without taking recourse to the Āgamas. Idols have no meaning when they do not meet the requirements of a Yantra as per tāntric stipulations. A duly installed Idol derives its power from the aroused Kuṇḍalinī of the Tāntric who installs it. One who has not mastered or gained control over the Kuṇḍalinī has no right to install an idol or to claim the stature of a Tantri. The last of such men who had this divinity in them were Śrī Rāmakrishna and Śrī Nārāyaṇa Guru who lived in the 19th century in Bengal and Kerala respectively.

It is apparent from the above that the Dharma as practiced by the Hindus today is unproductive of any spiritual bliss and violates all injunctions of Śrutis and Smṛtis. Hindus have no dogmatic compulsion to remain under the present paradigm of decayed traditions as the Śrutis enjoin upon every individual to strive for enlightenment and to share the enlightenment with the society. As noted by Romain Rolland:

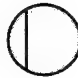
"The true Vedāntic spirit does not start out with a system of preconceived ideas. It possesses absolute liberty and unrivalled courage among religions with regard to the facts to be observed and the diverse hypotheses it has laid down for their coordination. Never having been hampered by a priestly order, each man has been entirely free to search wherever he pleased for the spiritual explanation of the spectacle of the universe".

In the words of Raṅganāthānanda:

"An impressive procession of students and teachers, earnest and sincere; a moving record of their animated discussions and graceful thought conflicts here in small groups and there in large assemblies...a singular absence of an atmosphere of coercion, open or veiled, secular or sacred, inhibiting the free pursuit of truth or its communication; the constant summons to man to verify for himself the truths placed before him for his acceptance; and the treatment of man as man and not as cut up into creeds, races and sex...".

What Romain Rolland refers as the Vedāntic spirit is in fact the Tāntric spirit that got camouflaged in the name of Veda due to reasons already expressed above. Tantra was a pre-requisite for the origin of the Vedas and as Tantra says, the Vedas had their origin in the Mūlādhāraṃ. To realize the truth of the Vedas, the Tāntric spirit has to be rejuvenated and the ceaseless inquiry and quest for truth must continue.

Whatever I have spoken here is only an introduction and the rest remains to be explored, discovered, and realized.



VIII

VEDIC ASTRONOMY

"Prajāpatiḥ paśūnasrjata
Te nakṣatram nakṣtraṃ upatiṣṭhan"

"Prajāpati created animals; they have occupied the asterisms (nakṣatras)"

Taittirīya Brāhmaṇa I: 5.4

"The experimental methods at Galileo's disposal were so imperfect that only the boldest speculation could possibly bridge the gaps between empirical data. For example, there existed no means to measure times shorter than a second"

A. Einstein

"A hitherto unpublished page of Galileo's working notes, preserved in Florence, implies a remarkably simple scheme for equalizing short time intervals. The secret of his success, it now appears was a song"

VIII

VEDIC ASTRONOMY

1. Salient Features

Ever since the days of early European scholars the antiquity and substance of ancient Indian astronomy had an aura of suspicion around it contributed by conflicting theses on the historicity and astronomical content of the Vedic hymns. Complexity and confusion increased further in the aftermath of the archaeological discovery of Indus valley civilization, when the antiquity deciphered out of the hymns by scholars like H.Jacobi and B.G. Tilak got credited to the so called Dravidians of Harappa at the cost of Vedic Ṛṣis by historians like D.P. Chattopadhyaya. The ensuing period witnessed a proliferation of speculative theories on the history of India and it's Vedic past woven around the theme of "Aryan Invasion". At the turn of the present century the trend is still continuing among the mainstream historians but certain recent developments have struck the very bottom out of the so called "Aryan Invasion Theory" and the ground is set for a revision of the established notions that place the Vedas chronologically at 1000-1500 BC. Portals of truth have begun to become apparent with the decipherment of the Indus script vis-à-vis the discovery of Vedic glossary on the Indus seals. The high antiquity of Vedas can no longer be doubted and the credibility of Vedic literary evidence stands reestablished. History of science as created by people like D.P.Chattopadhyaya is in dire need of revision as the Aryan myth has crumbled with the 'surfacing' of Sanskrit glossary (by the decipherment) in the ruins of Indus valley civilization. Time is thus ripe to attempt a better appreciation of the ancient Indian astronomical tradition that we find reflected in the Vedas, Purāṇas and the Epics.

An exhaustive account of the astronomical references contained in the Vedic literature is beyond the scope of this work. Moreover such detailed accounts are already available in the past works such as 'Bhāratīya Jyotiḥśastra' by S.B. Dikshit. Focus in our discussion shall be only to illustrate the astronomical development of those prehistoric days, which has remained hitherto unappreciated due to improper interpretation of the verses. Based on linguistic factors Vedic literature gets divided into different stages such as Saṃhitās, Brāhmaṇas and Upaniṣads followed by the Purāṇas and are credited to successive chronological periods. Also the general tendency is to consider the astronomical development apparent in the Brāhmaṇas as of later origin than the Vedas. Present author on the contrary consider the Brāhmaṇas, Upaniṣads Purāṇas and the Vedāṅgas as later compilations of the Vedic backlog and the scientific development perceptible in these works as representing the antiquity of the Samhitās, i.e., 4000 BC. As for example it will

be erroneous to consider the astronomical knowledge contained in Lagadha's Vedāṅga Jyotiṣa as the knowledge originated in 2400 BC or 1500 BC or 500 BC as per the estimates by different scholars. On the other hand it is a compilation of the earlier knowledge adapted for the epoch decipherable from the text viz., 2400 BC as per the interpretation by Holay. The Ṛksaṃhitā recognized as the earliest or primitive utterances of the early Vedic intellect in fact represents the mature phase of a civilization rather than the beginning. A language like Sanskrit could not have been evolved spontaneously among the aboriginal population as is evident from the fact that no comparable development is seen in aboriginal cultures that have prevailed elsewhere in the world. When the language could be so advanced as to win the admiration of the 20th century scientists I find no reason why their calendar or astronomy could be underdeveloped. It is true that if we look for the evidences in the Saṃhitās for advanced astronomical concepts, we will be disappointed – here in the fault lies with us rather than the Saṃhitās for we have looked in to the wrong place. Saṃhitās are compilations having no bearing on any special topic or purpose and in no way they can be supposed to contain a representative picture of the contemporary astronomy. The Saṃhitās alone as such cannot be expected to give a true picture of the astronomy or calendar and we need to consider the Vedic literature as a whole to make a creative appreciation of the salient features of the then prevalent astronomy. The important conclusions available from such a study can be summarized as follows:

(a) **Ecliptic or Zodiacal Belt in the Vedas**

Many scholarly attempts have already taken place during the last two centuries to collate the important calendarical references in the Vedas and a vast body of literature exists on the same. Some of the major finds are reproduced below:

- Ṛk X.85.5: Yatvā deva prapibaṃti tata āpyāyase punaḥ I
  Vāyu somasya rakṣitā samānāṃ māsa ākṛtiḥ II

"Oh Moon! The gods drink you, but later on you become bright again. The wind is the protector of the moon. Thou art the maker of *samas** (i.e. years), and of the months".

- Ṛk I.164.2: Sapta yumzamti rathamekacakrameko aśvo vahati saptanāma II
  Trinābhi cakramajaramanarva yatrema viśvā bhuvanādhitasthu: II

"Seven horses are harnessed to that one-wheeled chariot; but only one horse bearing 'sapta' (i.e. seven) names draws it. The wheel has three hubs or navels and it is eternal

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* As regards the connotation of the term *sama* S.B. Dikshit has given the following account:
"The word Varṣa which at present denote a unit of 364 or 365 days or some such interval, is not found in the same sense in the Ṛk-Yaju-Saṃhitās or the Aitareya, the Taittirīya, the Tāṇḍya or the Gopatha Brāhmaṇas, but it does occur in the Śatapatha Brāhmaṇa (II.2.3). In Ṛgveda, the names of seasons like Śarad have been for use denoting a year. Similarly, the words Saṃvatsara and Parivatsara are found so used in some places. In both the versions of the Yajurveda words like Śarad and Hemanta have not only been used several times in the sense of a year, but the word Saṃvatsara appears to have been used much more frequently. The word 'hāyana' has been used in the sense of a year in the Gōpathabrāhmaṇa (6-17). The word 'samā' has also been used in the sense of a year in the Vājasaneyī and Ṛksaṃhitās…"

and unhindered, and all worlds stand supported by it (i.e. chariot)"

- Ṛk I.164.14: Sanemi cakramajaraṃ vivāvṛta uttānāyām daśayuktā vahanti II
  Sūryasya cakṣu rajasaityāvṛtaṃ tasminnnārpitā bhuvanāni viśvā II

"That wheel which traverses only one path and which is indestructible always keeps revolving...It being the Sun's eye – it keeps on revolving. All worlds rest upon it".

- Ṛk I.164.22: Dvādaśāraṃ nahitajjarāya varvaṛti cakraṃ paridyāmrtasya II
  Ā putrā Agne mithunāso atra saptaśatāni viṃśatiśca tasthu: II

"The wheel (of time) having twelve spokes revolves round the heavens, but it does not wear out. Oh Agni! 720 pairs of sons ride this wheel".

- Ṛk I.164.48: Dvādaśa pradhayaścakramekaṃ trīni nabhyāni ka u tacciketa II
  Tasmintsākaṃ triśatā na śaṅkavo*f*rpitā: ṣaṣṭirna calācalāsa: II

"Twelve spoke-boards, one wheel, three navels, who understands these? In these there are 360 śaṅkus (rods) put in like pegs which do not get loosened".

(b) **Months were Lunar and Year Solar**

Moon offered a visible unit of time in the lunation and thus the term 'māsa' which was originally a synonym for the moon was later applied to denote the time unit of a lunation or month. No such convenient measure as the lunation is available for fixing a solar month.

- Taittirīya Saṃhitā 1.4.14 gives the names of the twelve regular months and the 13th intercalary month: Madhu, Mādhava, Śukra, Śuci, Nabhas, Iṣa, Urja, Sahas, Sahasya, Tapas and Tapasya and Saṃsarpa.

- Taittirīya Saṃhitā 4.4.11:"Madhu and Mādhava are the months of spring; Śukra and Śuci of summer; Nabhas and Nabhasya of the rainy season; Isa and Urja of autumn; Sahas and Sahasya of Hemanta and Tapas and Tapasya of winter".

- Taittirīya Saṃhitā 5.6.7: "One should remain consecrated for six nights because there are six seasons in a year...Consecration should be observed for twelve nights because there are twelve months in a year...Consecration should last for 13 nights as the year has 13 months...One should remain consecrated for 15 nights – half a month has 15 nights. A year is made up of 24 half months and thus consecration shall be for 24 nights. Remain consecrated for 30 nights because thirty Akṣaras make the Virāt. One should remain consecrated for a month because a month is a year".

Similar references are available in the Vājasaneyī Saṃhitā also.

- Taittirīya Brāhmaṇa 3.8.3: "Should the reins in a horse-sacrifice be twelve cubits in length or thirteen? The year consisting of seasons is a kind of bullock whose hunch is the

thirteenth month. The horse-sacrifice is the best of all sacrifices. The year in the form of a bullock has got a hunch (in the form of the 13^{th} month)".

Had the months been solar there is no question of a thirteenth month.

• Taittirīya Brāhmaṇa 3.10.1 has the listing of 24 half-months and 13 months occurring in a year and concludes with the declaration that Saṃvatsara (Year) is the Prajāpati.

• Amānta and Pūrṇimānta Months

Months reckoned respectively between the new moons and full moons are known as Amānta and Pūrṇimānta. The term Pourṇamāsi means the night on which month becomes pūrṇa or complete and it implies the Pūrnimānta reckoning in force. Dikshit has quoted Taittirīya Saṃhitā 7.5.6.1 to illustrate the prevalence of both the modes of reckoning i.e., months ending both on Amāvasyā and Pūrṇimā. Different verses suggest a mix-up of both the methods – in some verses the dark half is mentioned first suggesting the Pūrṇimānta reckoning while the Taittirīya Brāhmaṇa while enumerating the days gives the names of the days in the light half first followed by dark half suggesting the Amānta tradition. Use of the terms pūrva and apara pakṣas for Śukla and Kṛṣṇa pakṣas respectively in the Taittirīya Brāhmaṇa also indicate the prevalence of amānta reckoning.

(c) **Use of 'Tithi'**

Nowhere in the Vedic literature could Dikshit trace the use of the word 'tithi' in the sense of the 30 units of Moon's elongation. Amāvasyā, pūrṇimā and aṣṭakā have been interpreted as referring to the respective nights rather than the tithis as we have come to know in later times. Dikshit has noted that the term 'Pañcadaśi' has occurred in the sense of '15^{th}' in Taittirīya Brāhmaṇa and as such the use of 'Pratipad', 'Dvitīya' etc., to denote the respective nights of the lunation can be inferred. In the context of the luni-solar phenomena the following references are also noteworthy:

• Ṛksamhitā 10.85.5: "Oh Moon! The gods drink you, but later on you become bright again. Vāyu is the protector of moon. Thou art the maker of years and of the months".

• Taittirīyasamhitā 2.4.14: "The Suns make her bright, and when she is full, they drink her".

• Aitareyabrāhmaṇa 40.5: "The moon enters the sun on the new moon day. The moon is (again) born of the sun"

• Aitareyabrāhmaṇa 32.10 and Gopathabrāhmaṇa 6.10: " The former (part of) full moon night is called 'Anumati', the latter is called 'Rākā'; the former part of new moon night is 'Sinīvālī' and the latter 'Kuhū'".

• Nirukta 11.31: "According to Niruktas (etymologists) Sinīvālī and Kuhū are the wives of gods; but according to the sacrificers they are simply new moon nights".

• Ṛksaṃhitā 8.48.7: " Oh Somarāja! Increase the length of our lives just as the sun increases the length of days..."

• Taittirīya Brāhmaṇa 1.4.10: "Agni is the Saṃvatsara, Āditya the Parivatsara, Candrama the Idāvatsara and Vāyu the Anuvatsara".

(d) **Udagāyana and Dakshiṇāyana**

• Śatapathabrāhmaṇa 2.1.3: "Vasantha, Grīṣma and Varṣa seasons belongs tp the gods while Śarad, Hemanta and Śiśira are of the Pitṛs. When sun turns north he enters the region of the gods and on turning south enters the world of Pitṛs".

• Maitrāyaṇī Upaniṣad, Nārāyaṇa Upaniṣad, Taittirīyasaṃhitā 6.5.3 etc., contain the similar description of the Udagāyana and Pitṛyāna as respectively the northern and southern course of sun belonging to the Devas and Asuras.

(e) **Seasons**

• Number of seasons has been mentioned differently as 3, 4, 5 and 6 in the Vedic literature. Taittirīya Brāhmaṇa (2.7.10) has spoken of the five "Śāradīyas" as seasons of the year. Aitareya Brāhmaṇa (1.1) also has such a mention where Hemanta and Śiśira have been considered together as one season.

• Taittirīya Brāhmaṇa1.1.2.6.7: "spring is the mouth of the seasons"

• Taittirīya Brāhmaṇa 3.10.4.1: "The spring is the head of the year; the summer is the right wing; the monsoon forms the tail; autumn the left wing and winter the central part".

• Taittirīya Saṃhitā 6.5.3: "Two faced is the vessel of seasons; who knows which one is the mouth of the seasons".
•Taittirīya Brāhmaṇa 3.10.1 declares Saṃvatsara as the Prajāpati. Śatapathabrāhmaṇa (1.6.3) contains the following elaboration:

"After mankind was created by Prajāpati, his parvas (knuckles) became loose. The samvatsara (year) itself represented the Prajāpati. The two points of day and night i.e. twilight, the full moon and the new moon and the commencement of seasons – these are his parvas. The gods diagnosed the disorder. They cured the 'joints' of day and night and set them in their correct places by maintenance of agnihotras (sacred fires). The full and the new moons were correctly adjusted by the Pournamāseshti and Darśeshti and the joints of seasons were set right by means of the 'Cāturmāsyayajna' (i.e., four monthly sacrifices)".

(f) **Equinoctial Day**

According to Dikshit:

"Nowhere in the Vedas do we find a reference explicitly defining Viṣuavan as that day on

which the day and night are of equal length. It simply means an interlude occurring in the course of the 'satra' or 'ṣaḍahas', no matter whether the 'satra' continued for the whole year or for only a few days (see the Tāṇḍya Brāhmaṇa 13.4.16 and the commentary thereon Sāyanācārya)...."

In the light of the above observation it is doubtful as to whether we can interpret the term 'Visuvan' truly as the equinox unless it occurs in the context of the movement of the sun.

(g) **Nakṣatras**

Dikshit has quoted Ṛksaṃhitā I.50.2; X.68.11, Atharvaveda XIII.2.17; XX.47.14, which use the term nakṣatra to mean the stars. Other terms used to mean the stars are 'str', 'nabhas' and 'rōcana'. Ṛksaṃhitā contains explicit mention of only a few stars such as 'Tiṣya' (Puṣya), 'Citrā', 'Revatī', Aghā (Maghā) and Arjunī (Phālguni). By comparing the references to Maghā and Arjunī in Ṛk and Yajur Saṃhitās Dikshit has concluded that the nakṣatra system described in the Yajurveda was fully in vogue in the Ṛgvedic times. Taittirīya Saṃhitā VII.5.25 has made a distinction between the nakṣatras and the stars. N. Achar has brought in a new dimension to the research on antiquity of the nakṣatra scheme by referring to the Ṛkjyotiṣa (verse: 9) practice of enumerating the nakṣatras by the name of the deities. Coupled with the Taittirīya Brāhmaṇa statement "Devagṛhāvai nakṣatrāṇi" it is quite logical to interpret that the names of the deities in the Vedas in fact refer to the respective nakṣatras. Taittirīya Śṛuti, Saṃhitā and Brāhmaṇa contain many lists of all nakṣatras and Dikshit has given elaborate discussion on this aspect. From the data provided by Dikshit the following list of 27 nakṣatras, which represent the 27 equal divisions of the moon's path can be extracted.

No.	Name	Deity	Gender	Number
1	Kṛttikā	Agni	Feminine	Plural
2	Rohiṇī	Prajāpati	Feminine	Singular
3	Mṛgaśīrṣa	Soma	Feminine	Singular
4	Ārdra	Rudra	Masculine	Singular
5	Puṇarvasu	Aditi	Masculine	Dual
6	Tiṣya	Bṛhaspati	Masculine	Singular
7	Āśļeṣā	Sarpa	Feminine	Plural
8	Maghā	Pitṛ	Feminine	Plural
9	Phālgunī (pūrva)	Āryamā	Feminine	Dual
10	Phālgunī (uttara)	Bhaga	Feminine	Dual
11	Hasta	Savitā	Masculine	Singular
12	Citrā	Indra/ Tvaṣṭā	Feminine	Singular
13	Svātī / Niṣtyā	Vāyu	Feminine	Singular

14	Viśākhā	Indrāgni	Feminine	Dual
15	Anūrādhā	Mitra	Feminine	Plural
16	Rohiṇī /Jyeṣṭhā	Indra	Feminine	Singular
17	Vicṛatau	Pitṛ	Masculine	Dual
18	Āsāḍhā (pūrva)	Āpaḥ	Feminine	Plural
19	Āṣāḍhā (uttara)	Viśvedeva	Feminine Feminine	Plural
20	Śṛona	Visnu	Feminine	Singular
21	Śṛavisṭhā	Vasu	Feminine	Plural
22	Śataviṣak	Indra /Varuṇa	Masculine	Singular
23	Proṣṭhapada	Ajaekapad	Masculine	Plural
24	Proṣṭhapada	Ahirbudhniya	Masculine	Plural
25	Revatī	Pūṣā	Feminine	Singular
26	Aśvayuja	Aśvin	Feminine	Dual
27	Apabharaṇī	Yama	Feminine	Plural

There has been a controversy as to whether the nakṣatras are 27 or 28? The 28th one or Abhijit would not have been in reckoning as a nakṣatra division as it stands farther away from the moon's path. The tradition of counting Abhijit among the stars might have originated in the distant past when the full moon over it marked the beginning of spring and the New Year.

Apart from the listings we can find legends about the origin of their names as well as cryptic mythological episodes in Vedic literature. As for example, in Aitareya Brāhmaṇa13.9, Prajāpati's love for his daughter Rōhiṇī is described in following terms:[1]

"Prajāpati felt love for his own daughter – the sky, some say, the Uṣā (dawn) others. She became a rohit i.e. a deer. He became a 'ṛsya' (a white footed antelope) and went up to her. The gods saw him and remarked: 'Prajāpati is now doing a deed improper'. They sought one who would punish him; but they did not find anyone among them. Then they brought together in one place their most dreadful forms. Brought together, they became a deity; therefore his name contained the word Bhūta. He was then born who knows thus his name. To him the gods said, 'Prajāpati here hath done a deed unknown, pierce him'. 'Be it so', he replied. 'Let me choose a boon from you'. 'Choose' (they said). He chose this boon, 'the over lordship of cattle'. Therefore does his name contain the word "cattle". He who thus knows his name becomes rich in cattle. Having aimed at him, he pierced him, being pierced he flew upwards, him they call the 'deer'. The piercer of the deer is he of that name (Mṛgavyādha). The female deer is Rōhiṇī. The (Trikāṇḍa) is the three pointed arrow".

[1] Dikshit, S.B., Bhāratīya Jyotiḥśāstra, Vol. I., pp. 51 -52

A legend of this kind – symbolic description of an astronomical observation – could have taken shape only in a society capable of appreciating the creativity involved. As is being

interpreted by many scholars the legend refers to the shifting of the equinoctial year beginning to Rohini around 3200 BC.

2. Śyāmaśāstri on Vedic Calendar

Śyāmaśāstri has given the following synopsis of the two similar hymns viz., Atharvaveda III.10 and Yajurveda Taittirīya Saṃhitā IV.3.11:

"The important points to be particularly noticed in the above passages are:

(1) The beginning of the year, probably solar, on the eigth day of the dark half of the month Māgha
(2) The designation of this day by such names as 'a cow', 'dawn' 'Prajāpati's daughter' and 'Sūryā'
(3) The association or a kind of secret marriage of the dawn with three lights, the fire, the moon and the sun, as pointed out by Sāyana in his commentary on verse1
(4) The birth of the days of the following year or cycle of years as well as of Indra and Soma from the marriage of the dawn with the sun
(5) Celebration of the dawn by the four well known Sāma-chants viz., the nine-versed chant, the fifteen-versed chant, the seventeen versed chant and the twentyone-versed chant, each of which is as we shall see intended to signify as many intercalary days as the number of verses contained in it
(6) The destruction of enemies and Asuras brought about by Indra, the son of the dawn

As regards the first point it is true that we are told nowhere in the Vedas themselves that the word ekāṣṭaka means the eigth day of the dark half of the month of Māgha; still on the authority of Āpastaṃba and other Sūtra writers, who have defined it as such, we may take it to mean that particular day. From the next three points we have to understand that at the commencement of every year or cycle of years, it was the usual custom with the Vedic poets to celebrate symbolical marriage of the New Year's day with the sun in order to enable the new year to beget its 720 children, i.e., its days and nights, or in other words, to perpetuate an auspicious flow of time for themselves. This seems to be the sum and substance of the celebrated marriage hymns[2], in which the marriage procession of Sūryā or the dawn to be wedded to the sun is the subject of a long and mystic description, and which are even now recited on the occasions of marriage performed as a rule after the winter solstice and before the summer solstice. The recognition of the dawn first by Soma - the moon, next by Gandharva - one of the 27 nakṣatras, then by Agni, and lastly by men seems to signify the association of the dawn first with the synodic lunar year of 354 days, next with the sidereal lunar year of 351 days containing 13 months each of 27 days corresponding to 27 nakṣatras or Gandharvas, then with the Sāvana year of 360 days dedicated to the sacrificial fire-god from whom the dawn or the twenty-first day, based upon the difference between the Sāvana year and the Julian solar year of 365.25 days, is believed to have come under the protection of observance of men. The fact of making the dawn the object of praise in the Catuṣtomas or four sets of Soma-chants seems to render probable the above explanation of the two obscure verses of the marriage hymn. The five mornings, which are said to precede the brilliant dawn in verse 11, seem

[2] Ṛksaṃhitā 10.85.13 is noteworthy in this regard:
"The (dowry) of cows which was given by Savitā (sun) had already gone ahead of Sūryā. They drive the cows on the Aghā nakṣatra. The daughter was carried away on the Arjunī star". (Dikshit, p.44)

to be five days added after the end of the Sāvana year. As regards the destruction of enemies and Asuras by Indra, we shall presently see that they are not real enemies or Asuras, but intercalary days regarded as such".

• Sāmaveda II.1.17.3, VI.2.2.7 etc., also speaks of the twenty-one cows or intercalary days occurring in four solar years of 365.25 days in cryptic language.

• On the Intercalary Month, important quotes provided by Śyāmaśāstry are reproduced below:

• Kṛṣṇa Yajurveda, I.4.14 enumerates the twelve months and the thirteenth month as Madhu, Mādhava, Śukra, Śuci, Nabhas, Nabhasya, Iṣa, Urja, Sahas, Sahasya, Tapas, Tapasya and Saṃsarpa. The Brāhmaṇa portion of Kṛṣṇa Yajurveda VI.5.3.12 has provided further elaboration as:
"Clearly does the Adhvaryu first go to the south; clearly the Pratiprasthātri priest to the north. Hence does the sun go to the south for six months and to the north for six months. He says: 'Thou art caught in a wooden vessel; thou art Saṃsarpa [a creeping month] and a receptacle for sins'. They say that there is also a thirteenth month; it is that thirteenth month which he pleases thereby".

To this passage Śyāmaśāstry has appended the following explanation:

"*The symbolical practice connected with this passage is this: The Adhvaryu priest fills thirteen wooden vessels with Soma-juice; and with the help of another priest, called Pratiprāsthātri he makes offerings therefrom to the seasons. While performing the rite, the Adhvaryu goes to the south and the Pratiprāsthātri to the north, imitating the southern and northern movements of the sun respectively. As will be seen, it was in the middle of the year during the summer or the winter solstice, accordingly as the year began with the winter or the summer solstice, that the intercalary period was inserted, delaying the sun's turning movement so long and occupying that period in performing the initiatory rites. Hence the reference in this passage to the sun's northern and southern movements, and to the thirteenth month during which the commencement of those turning movements is delayed....*"

• **Gavāṃ Ayana**

To quote Śyāmaśāstry:

"*The general name by which the various forms of the Vedic calendar were known seems to have been Gavāṃ ayana. It is only one of many forms of the Vedic calendar that I attempted to explain in my essay entitled 'Gavāṃ Ayana, the Vedic Era', published in 1908. Therein I have pointed out: (1) that the word 'go' (cow) means the intercalary day i.e., that day which is product of the four quarter-days at the end of four successive solar years, each of 365.25 days. (2) that the term Gavāṃ Ayana or "Cow's Walk" means a series of such intercalary days, on each of which the Vedic poets regularly performed cyclic sacrifices and (3) that in the Mahad Uktha or Great Litany of Ṛgvedic hymns they kept a record of 460 or 465 intercalated days as having elapsed*".

⇒ As the scholars have hesitated to accept what he described as indirect evidences, Śyāmaśāstry had to look for more direct evidences and he could find it in the Nidāna –

Sūtra of the Sāmaveda. To quote:[3]

(i) *"From this Sūtra we learn that Gavāṃ ayana is a name given to the year which contained some intercalated days inserted either in its middle or at its close. It appears that the number of days intercalated differed with different schools of Vedic astronomers and depended upon the difference between any two kinds of years selected for adjustment with each other. The school, which had adopted the synodic lunar year of 354 days and the sidereal solar year of 366 days, seems to have added to every lunar year a Dvādśāha or period of twelve days, during which they performed a sacrifice with recitation of a Sāma-chant of twelve verses on the last day. With the school, which had adopted the sidereal lunar year of 351 days, i.e., the year of thirteen months of 27 days each and adjusted it with Sāvana year of 360 days, the number of days added was nine. Those who had adopted the Sāvana year of 360 days and adjusted it with the solar year of 365.25 days seem to have been adding 21 days to every fourth Sāvana year. In this way there seems to have been during the Vedic period a variety of different astronomical schools, whose chief religious function was the performance of a grand sacrifice during each period of their respective intercalary days. A regular account of the 'Cows' or intercalary days which each school counted and observed is found preserved under the general title of Gavām ayana..."*

(ii) "These and other important points connected with the Vedic calendar are clearly explained both in the Nidāna Sūtra and the Srauta Sūtra of Lātyāyana; and it is a matter for regret that, important as these works are for elucidating the much vexed question of Vedic chronology, they have so long escaped the notice of oriental scholars...The passage of the Nidāna Sūtra in which a few forms of Gavāṃ ayana are defined, runs as follows:

V.11.12: "...Then the years of the classes: the classes (are) of five years. In them the sage by his wisdom will know the sessions of the ritual and the basic forms (of the sacrificial rites) and the vows or ceremonies (to be observed in them).

(The year) which is less (than the Sāvana year) by 36 (days), that which is less by 9 (days); that which is less by 6 (days) than the Sāvana year (of 360 days); then the year which is greater than the Sāvana year by 18 days. The sidereal (nākṣatra) year (of 351 days) has a thirteenth month (of 27 days). Then the two kinds of years: the lunar and the Sāvana. Then the year that is greater than the Sāvana year by 18 days: one has to observe (it) on every 38th or 37th fullmoon.

He has to know the four forms of Gavāṃ ayana. Of them, the sidereal year (of 324 days) is the first; its months are of 27 days each, because there are 27 naksatras. The mode of observing it (is this): in the place of each first [period of six days called] Abhiplava (of every month of 30 days) before the central day (of the year), one should observe [a period of only three days known as] Trikadruka: (likewise in the place) of each last (Abhiplava) after the central day. Some say that they (the Trikadruka days) are so devised as to be of the same form as the Abhiplava days; they have their place here; nor is their observance opposed to that of the Abhiplava days. It is also known that like the Svarasāman days the unit of three days [the Trikadruka days] is devised as a special period of three days. The three Trikadruka days as well as the five days of the six Abhiplava days are observed together in the sacrificial session of seventeen nights. Others say that the Trikadruka days are the same as the Svarasāman days. And thus the usual form of the calendar days and their rites is not lost; for the Trikadruka days have their own independent place in all sacrificial sessions.

Then (the year of 351 days) which is less (than the Sāvana year) by nine days; thus it has thirteen months (each of 27 days). He has to omit nine days in the two intercalary months [sambhārya, i.e., the sixth and the seventh, each of 30 days]; four days (are to be omitted) before the central day of

[3] Śyāmaśāstry, The Vedic Calendar, p.21

the year and five days after it. This is how it is done: in the place of the first Abhiplava (of the sixth month of 30 days) before the central day, only two days known as 'jyotis' and 'go' are to be observed; and in the place of the last Abhiplava (of the seventh month) after the central day, only one day, known as 'jyotis' is to be observed. No central day occurs in the year (of 351 days) for it is counted in its latter half.

Then the lunar years (of 354 days) which are less (than the Sāvana year) by six days; in the first half (of this year) there are six months, beginning with one, which is full [i.e., consists of 30 days] and ending with one which is deficient [i.e., contains only 29 days]; in the latter (half there are six months) beginning with one which is deficient and ending with one which is full. This is how it is observed: in the deficient months before the central day, in the place of each first Abhiplava one should observe (only) five days of Abhiplava; (likewise in the place) of each last (Abhiplava) in the deficient months after the central day.

The Sāvana year of (360 days) has been explained. It is this same sidereal year of the sun. The sun is known to pass through (each of) the nakṣatras in a fixed number of days: he remains in each nakṣatra for thirteen and thirteen days together with a third part of a day and two out of nine kalās or parts of a day and night [i.e., of a whole day]: these kalās or parts amount in a year to 54 and are equal to six times nine kalās [i.e., 6 days]; thus it consists of 366 (days) as contrasted with the Sāvana year consisting of 360 days. There are two verses about this:

Twenty-seven are the mansions in the kings [i.e., the sun's] dominion; thirteen and thirteen days he resides in each naksatra: thitrteen days and one-third of a day; thus dividing four times ten days into three equal parts, he traverses the broad and ancient path of thrice nine stations in the course of forty periods, each of nine nights.

Then the year of the sun of 378 days which is greater than the Sāvana year by eighteen days; this indeed is made by his transverse motion. It is well known that the sun always goes to the north for six months and nine days and likewise to south. Accordingly there are the following verses:

Who knows that year in which the solar, the lunar and the sidereal months are not lost. Who knows that? In the year measured by 37 or 38 (full moons), the solar, lunar and the sidereal months are not lost. The sun goes to the south for twenty-seven times seven days and likewise to the north for twenty-seven times seven days.

This is how this year is observed: In the two intercalary months one should intercalate eighteen days; nine days before the central day of the year and nine days after it. Three Trikadruka days and six Abhiplava days before the central day and six Abhiplava days and three Trikadruka days after the central day".

Similar forms of calendar together with some varieties are also described in the Śrauta-Sūtra of Lātyāyana, IV.8.1-7. Further, quoting from Nidānasūtra VIII.11 Śyāmaśāstry has given illustration of the ancient knowledge that the sixth day of the "Ṛtu-ṣaḍaha" is a result of the accumulation of the one-quarter of a day and that these days in fact created the seasons or made the seasons to return regularly. Kṛṣṇa Yajurveda also states clearly that the five days after the close of the Sāvana year have the power of creating seasons:

VII.1.10: "The year of 360 days was of yore undifferentiated; it desired that it might create the seasons; it saw the five nights, caught hold of them and sacrificed by them; then it created the seasons...the seasons once created did not regularly return again; they saw the five nights, caught hold of them and sacrificed by them; then they regularly returned...Four nights are less; six nights are more; the sacrificial period of five nights is neither less or nor more...."

On the verses quoted, Śyāmaśāstry comments further:

"If we read the above three passages along with Agnisvāmin's commentary on Lātyāyana's aphorism IV.6.12 and the two verses of the Sāmaveda II.1.17.3 and VI.2.2.7 together with the verses of the Atharvaveda IV.15.13 and IV.16.6, all of which are quoted above we can clearly

understand that when the Vedic poets recognized the failure of the synodic lunar and the sāvana years to keep pace with the course of the seasons, some of them seem to have discovered the sidereal solar year of 366 days and regarded it as capable of agreeing with a round of the seasons. Others with more accurate observation seem to have been divided in their opinion and to have taken a vague solar year of 365 days according to some, and a more true solar year of 365.25 days according to others, as the one fairly agreeing with the course of the seasons. Those who observed the synodic lunar year of 354 days seem to have been passing 12 days in Dikṣā or vow of initiation after its close and before the commencement of the sidereal solar year...those who were still more accurate in their observation appear to have framed a cycle of 4 Sāvana and solar years and to have adjusted the sāvana year with a solar year of 365.25 days by adding 5.25X4 = 21 days to every fourth sāvana year... There is no reason to doubt that it is these twenty-one days which as stated by Agnivāmin were inserted in the middle of the year as an alternative for the twelve days inserted by others. We may therefore take it for granted that the statement of the Tāṇḍyamahābrāhmaṇa XXV.18.1, that "five times fifty periods of 21 days make one thousand years of the Viśvasṛiks", is one which was based upon an actual practice and was not a mere theoretical problem as has been held by one critic of my views".

This lengthy account has been reproduced to illustrate the fact I have pointed out at the beginning of this section that the Saṃhitās were not the right place to look for the astronomical development in Vedic times. The difference between the Sāvana year (360 days) and the sidereal year (of 366 / 365.25) has been illustrated with remarkable expertise – in terms of the surplus 2/9 days spent by sun in each nakṣatra. Also, we can find in the above a mention of dividing 40 days equally into three by sun – obviously the reference is to 40 degrees or three nakṣatras traversed by sun in 40 days. Apart from the 1000-Year cycle referred above, Sāstry has referred to the 12-Year Prajāpati cycle, 36-Year cycle of the Sāktyas and 100-Year cycle of the Sādhyas.

3. Daftari's Discoveries...

Dr. K.L.Daftari's work 'The Astronomical Method and its Application to the Chronology of Ancient India' is a remarkable piece of research on ancient Indian astronomy and the astronomical content of Vāyupurāṇa. His noteworthy perceptions include:

(a) Despite the blemish credited to the Purāṇic literature by the mainstream historians, Daftari has taken the Vāyu and Brahmāṇḍa Purāṇas as of valid historical content.

Vāyupurāṇa 103.49: "The learned Brāhman who hears or tells or teaches this old history will enjoy happiness for eternity in the abodes of Mahendra".

Vāyupurāṇa 103.56: "Having heard this history (Ithihās) a man sets his heart upon Dharma".

Both the Vāyu and the Brahmāṇḍa purānas credit the origin of the treatise to Vāyu:

"I will tell you the Purāṇa that was formerly told by Vāyu to the sages of the Naimiṣa forest".
[Brahmāṇḍa Purāṇa 1.36-37; Vāyu Purāṇa 1.47-48]

(b) Content of the Brāhmaṇas

Śatapathabrāhmaṇa 13.1.1.1: "Saṃvatsaro vai yajṅaḥ prajāpatiḥ..."

The subject matter of the Brāhmaṇas is Yajṅaḥ or sacrifice equated to the 'year' and this implies that the Brāhmaṇas shall have contents related to the movements of the sun and the length of the year.

(c) Interesting Interpretations of Mahābhārata verses

In fixing the date of the Mahābhārata War Daftari has made use of the following propositions:

• Week-days were known in ancient India –at the time of Mahābhārata. He quotes Atharva Jyotisa verse 93:

"Āditya: Somo Bhaumaśca tatha Budhabrhaspatī I
Bhārgava Śanaicaraśceva ete sapta dinādhipāh II

• Interpretation of the following verses from the Mahābhārata is noteworthy

→ Bhīsma Parva, Chapter 3:31-33, translation by Daftari is quoted below:

"*Both the sun and the moon became eclipsed on the 13th Tithi on the same day of the week, i.e., at an interval of 14 days. Having become eclipsed on a day other than that of Pouranimā or Amāvāsya, they desire the destruction of the populace. I have seen Amāvāsya on the 14th, 15th or the 16th tithi but never like this on the 13th tithi. Both the sun and moon were eclipsed on the 13th tithi in the same month. Being eclipsed on a day other than Amāvāsya or Pourṇimā, they will destroy the populace*".

Daftari has interpreted the word "Ekāhnā" to mean "On the same day of the week" and has explained the absurdity occurring in the above verses of 'eclipses on the 13th tithi' as due to the conflict between the then prevalent calendar computation and the actual phenomena. That is, in the above case the the real tithi was in advance of the computed tithi on account of the excessive length of the lunar month employed in the calculation. To quote:

"*...The real length of 62 lunar months is 1830.8964 days. But if a period larger than this, i.e., 1831 days as in the Yajur-Vedānga Jyotisha or 1830.9375 days as in the Pitāmaha Siddhānta be taken as the length of 62 lunar months, every calculated tithi would come later than the actual tithi. The interval between the calculated and the actual tithi would increase as the Cycles advance and the statements given above show that it had accumulated to the extent of about two tithis at the time of the War...*"

• In Mausala Parva, Chapter 2: Verses 18 –19:

"Having seen that Amāvāsya on the 13th tithi (at sunrise), Kṛṣṇa said – Rāhu has again made this 14th tithi the 15th tithi. It had come at the time of the Mahābhārata War and it has come again for our destruction".

I shall be referring in detail on the date of the Mahābhārata War subsequently. These extracts from Daftari's essay have been provided only to illustrate the role of creative interpretations in dealing with literature of the prehistoric period – what difference a creative interpretation will make to an absurdity apparent in the examination using imperfect knowledge. Note especially in the above quote: "Rāhu has again made this 14th tithi the 15th..." i.e., the eclipse or the effect of Rāhu has made them realize that the tithi is actually 15th rather than 14th as arrived at by compuation.

(d) On Ancient Chronology

Daftari had dispensed with the popular Yuga sytem as having no relevance to history to defend his own dating of the Mahābhārata War to have taken place in 1197 BC. He has drawn a distinction between the Yugas of Mahābhārata and the astronomical Yugas.

• Important References on Vedic Astronomy Used by Daftari

(i) Śatapatha Brāhmaṇa VI.7.1.18:

"The year is the Agni and the seasons are the sling (for holding it) for the year can stand by the help of the seasons. By the seasons only does (one) support the year. The word Śikya (sling) is derived from Śak, which means 'to be able'. The seasons are therefore called Śikya because they are able to support the year".

(ii) Taittirīya Saṃhitā VII.5.1: "The six seasons constitute the year. They (men) stand in the year by standing in the seasons".

(iii) With quotations from Brāhmaṇa literature Daftari has shown that the Vedic Calendar consisted of three years of 360 days and one 'long year' or 'fourth year' of 381 days.

(iv) Śatapatha Brāhmaṇa Kāṇḍa 13, Chapter 2, Brāhmaṇa 11: "Prajāpati (i.e., the year) desired that he should be great (long); he saw in Aśvamedha two Grahas that could lengthen him. He offered oblations to them and thereby he became great (long)".

(v) Taittirīya Saṃhitā 4.3.11: "The eye of the Prajāpati increased (grew); while growing it fell away. From it a horse came into being. A horse is called Aśva, because it grew Aśvayat. That (the eye) the Gods sent again in its place by the Aśvamedha itself. Therefore he who sacrifices by the Aśvamedha, i.e., performs the Aśvamedha sacrifice, makes the Prajāpati complete".

(vi) Yuga of four years

→ Vāyu Purāna (Chapter 50.182) has been quoted to suggest that the five years beginning with Samvatsara were obtained by the modification of the four years.

→ Śatapatha Brāhmaṇa, Kāṇḍa 10. Chapter 4, Brāhmaṇa 2:

"Year is the Prajāpati who is also the Agni (Sacrifice). He arranged the Ṛgveda into twelve thousand Bṛhatis for only so many are the Ṛk hymns created by the Prajāpati...

He then arranged the other two Vedas into eight thousand Bṛhatis...for so many only are the hymns of these Vedas created by the Prajāpati".

To this quote Daftari provides the commentary:

"This clearly states that the hymns of all the Vedas were created by the Prajāpati, i.e., the year. This only means in non-poetical language that hymns were made at a regular interval of years. We also know that the Aśvamedha was performed every 'fourth year' to make the Prajāpati or year complete. These two facts combined together show that the Prajāpati is said to have created hymns because they were made for the Aśvamedha that was performed for completing the Prajāpati and therefore that hymns were made every 'fourth year' for the Aśvamedha performed every fourth year to complete the year".

→ Vāyupurāṇa 59.57:

Pratimanvantaram caiva sṛutiranyāvidhīyate I
Rco yajūmṣi sāmāni yathāvatpratidaivatam II

" New Vedas are made in every Manvantara, viz., Ṛk, Yajuṣ and Saman for every deity".

→ Vāyupurāṇa 61.169: "When the Manvantara is finished the Ṛṣis and Manus abandon their offices and go up to the happy Maharloka with the mantras".

Daftari:[4] "This clearly means that the hymns in the old Manvantara could not be used in new Manvantara and that therefore new mantras had to be composed in every manvantara. There is further evidence to support this conclusion.... The word Chandoma (Chandāmsi mīyante vā nirmīyate yeshu te divasāh) means those days in which the hymns are composed or measured to see if the prescribed length of hymns is composed. Though we do not find in the Brāhmanas of today such an act of composing or measuring hymns, the derivation of the word Chandoma is itself so very certain that it can point to no other conclusion than that new hymns were composed every 'long year'. The following passage also confirms this conclusion:

Ṛk VI.8:'Give wealth useful for Yajna and fame to us, who sing new praises to u in every Yuga"

[4] Daftari: P. 148

As a Yuga has been shown to be equal to four years this means that new Rk, Yajush and Saman were composed every fourth year (for Aśvamedha ofcourse). Incidentally this passage also shows that the Manvantara was the same thing as a Yuga i.e., a period of four years".

• Vāyupurāṇa on Yugas

→ Chapter.32, 7-19

Kṛtaṃ Tretā Dvāparaṃ ca yugādiḥ kalināsaha I
Parivartamānaistairevaṃ bhramamāṇeṣu cakravat II7II

Devatāstu tadodvignāḥ kālasya vaśmāgatāḥ I
Na śaknuvaṃti tanmānaṃ saṃstāpayitumātmanā II8II

Tadā te vāgytābhūtvā ādau manvantarasya ha I
Ṛṣayacaiva devāśca indraścaiva mahātapāḥ II9 II

Samādhāya manastīvraṃ sahasraṃ parivatsarān I
Prapannāste mahādevaṃ bhītāḥ kālasya vai tadā II10 II

Ayaṃ hi kālo deveśaścaturmūrtiścaturmukhaḥ I
Kosya vidyānmahādeva agādhasya maheśvaraḥ II11II

Atḥa dṛṣṭvā mahādevastaṃ tu kālaṃ caturmukhaṃ I
Na bhetavyamiti prāha ko vaḥ kāmaḥ pradīyatāṃ II12II

Uvāca devo bhagavān svyaṃ kālaḥ sudurjayaḥ II13II

Ydetasya mukhaṃ śvetaṃ caturjihvaṃ hi lakṣyate I
Etatkṛtayugaṃ nāma tasya kālasya vai mukhaṃ II14II

Yadetadraktavarṇābhaṃ dvitīyaṃ vaḥ smṛtaṃ mayā I
Trijihvaṃ lelihānaṃ tu etattretāyugaṃ dvijāḥ II15II

Yadetadvai mukhaṃ bhīmaṃ dvijihvaṃ raktapingalaṃ I
Dvipādotra bhaviṣyāmi dvāparaṃ nāma tadyugaṃ II16II

Yadetatkṛṣṇavarṇābhaṃ turīyaṃ raktalocanaṃ I
Ekajihvaṃ prthuśyāmaṃ lelihānaṃ puaḥpunaḥ II18 II

Tataḥ kaliyugaṃ ghoraṃ sarvalokabhayaṃkaraṃ I
Kalpasya tu mukhaṃ hyetat caturtḥa nāma bhīṣaṇaṃ II19II

The substance of this passage is as follows (Page.149):

"As the four yugas, the Kali, the Dvāpara, the Treta and the Kṛta were revolving like a wheel, the Gods could not determine the dimensions of time (year). Therefore prior to the

Manvantaras, they (Ṛṣis, Devas, and Indra) concentrated their mind for one thousand years and prayed to Mahādeva and asked: 'Oh, Lord, this time (of thousand years) has four heads and is composed of fours i.e., quaternaries (caturmūrtiḥ); who would know this time?'. Mahādeva said: Its head named the Kṛta has four tongues, Treta has three tongues, Dvāpara has two and Kali has one. This is the 4th head of the Kalpa."

This gives the ratio 1:2:3:4 for the four heads viz., Kali to Kṛta Yugas of the 1000 year Kalpa. That is, Kaliyuga = 100, Dvāpara = 200, Tretayuga = 300 and Krtayuga = 400 years.

→ Chapter 98, 88-93

Etāstisraḥ smrtāstasya divyāḥ sambhūtayaḥ śubhāḥ I
Mānuṣyāḥ sapta yāstasya śāpajāstānnibodhata II 88 II

Tretāyuge tu daśame Dattātreyo babhūva ha I
Dharmenaṣṭe caturthaśca Mārkaṇḍeya puraḥsaraḥ II 89 II

Pańcamaḥ pańcadaśyāṃ tu tretāyāṃ saṃbabhūvaha I
Māndhātā cakravartī tu tadottankapuraḥsaraḥ II 90 II

Ekonavimśe tretāyām sarvakshtrāntako abhavat I
Jāmadagnystathā ṣaṣṭo Viśvāmitrapuraḥsaraḥ II 91 II

Caturvimśeyuge Rāmo Vasiṣṭhena Purodhasā I
Saptamo Rāvaṇasyārthe jajne Daśarathātmajaḥ II 92 II

Aṣṭamo dvāpare Vishnurashtāvimse Parāśarāt I
Vedavyāsastato jajńe jātūkarṇapurahsaraḥ II 93 II

The conventional approach based on the astronomical Yugas interprets the passage as:

"These three are said to be His divine incarnations. Now learn His seven human incarnations brought about by curse. The fourth incarnation Dattātreya was born in the Treta of the tenth Mahāyuga. The fifth incarnation, Māndhātā was born in the Treta of the 15th Mahāyuga. The sixth incarnation Jāmadagnya Rāma was born in Treta of the 19th Mahayuga while the seventh incarnation Dāśarathi Rāma was born in the Treta of the 24th Mahāyuga. The eighth incarnation Veda Vyāsa, son of Parāśara was born in the Dvāpara of the 28th Mahāyuga".

As noted by Daftari, the use of astronomical values such as 4320000 years for the Mahāyuga leads to a most absurd chronology:

"...the interval between Dāśarathi Rāma and Vedavyāsa would be equal to four Mahāyugas and one Tretāyuga at least i.e., equal to 18576000 years and the interval between Jāmadagnya Rāma and Dāśarathi Rāma would be five Mahāyugas i.e., 21600000 years nearly. We, however know definitely that Brhadbala, a descendant of

Dāśarathi Rāma, fought and was killed in the Mahābhārata war and that this Brhadbala was the 25^{th} descendant of Dāśarathi Rāma according to the Bhāgavatapurāṇa, 32^{nd} descendant according to the Viṣṇupurāṇa and the Vāyupurāṇa. Vedavyāsa was the grandfather of the Pāndavas who fought the Mahābhārata war. Therefore we will have to hold that 30 generations are equal to 18576000 years. In the same way since it is said that Jāmadagnya Rāma was a contemporary of Dāśarathi Rāma we will have to hold that Jāmadagnya Rāma lived for 21600000 years. Plainly these are impossibilities, as we know that a generation is never greater than 25 years and that the span of a man's life does not much exceed 100 years. Even if we hold that a Mahāyuga is a combination of the Kali of hundred years, the Dvāpara of 200 years, the Tretā of 300 years and the Krta of 400 years, i.e., that a Mahāyuga is equal to 1000 years, we still get the interval between Dāśarathi Rāma and Vyāsa to be 4300 years and the life of Jāmadagnya Rāma to be 5000 years and 30 generartions to be equal to 4300 years. These also are impossibilities. We are therefore constrained to construe the passage in another and a reasonable way, taking that the words tenth, fifteenth, nineteenth, twenty-fourth and twenty-eigth represent subdivisions of the Tretā and Dvāpara, namely, the quarternaries (i.e., the 4-year Yugas). This finds support in the fact that the word 24^{th} (Caturvimśe) in the 92^{nd} stanza qualifies the word Yuga which as we have seen means a quartenary. The correct rendering of the passage is therefore as follows:

"These are His three divine incarnations. Now learn His seven human incarnations brought about by curse. The fourth incarnation Dattātreya was was born in the tenth quarternary of the Tretā, the fifth incarnation Māndhātā was born in the 15^{th} quarternary of the Tretā. The sixth incarnation Jāmadagnya Rāma was born in the 19^{th} quarternary of the Tretā while the seventh incarnation Dāśarathi Rāma was born in the 24^{th} quarternary. The eighth incarnation Veda Vyāsa, son of Parāśara was born in the 28^{th} quarternary of the Dvāpara".

Despite the merits of this interpretation that makes the Purāṇic account comprehensible, Daftari could not reconcile the same with the Purāṇic count of generations between Dāśarathi Rāma and the time of the Mahābhārata war. Discarding the 25/32 generations of Bhāgavata and Viṣṇu Purāṇas, Daftari accepted the count of 15 generations given in Matsyapurāṇa between Dāśarathi Rāma and Śrutāyu, who was killed in the Mahābhārata war.

- **Duration of a Kalpa**

Daftari:

"Why was the Kalpa called a Kalpa? The reason is that the Manu, Saptarṣis and other Devas or Public functionaries were freshly elected or selected in every Kalpa. This would appear from the following passage. Vāyupurāṇa VII.18, 23 -26:

> Kṣīne Kalpe tadā tasmin dāhakāla upasthite I
> Tasminkalpe tadā devā āsan vaimānikāstu ye I
> Ekaikasmistukalpe vai devā vaimānikāh smrtaḥ II 18 II

Devāśca pitaraścaiva munīyāmanoustathā I
Tataste avaśyabhāvitvāt budhyā paryāyamātmanaḥ I
Devā ihasthānābhimāninaḥ II 23 II

Sthitakāle tadā pūrṇe āsanne paścimemtare I
Kalpāvasānikādevāh tasmin prāpte hi ushapḷave II 24 II

Tenoutsukyavishādena tyktvā sthānāni bhāvataḥ I
Maharlokāya samvignāstataste dadhire matim II 25 II

Te yuktā upapadynte mahasi sthaih(svaih) śarīrakaiḥ II 26 II

Meaning: "When the Kalpa came to an end and the time of burning (offering in the Aśvamedha) arrived, the Vaimānika Gods that were in that Kalpa namely, Gods, Pitṛs, Ṛṣis and Manus whose authority terminates by a Kalpa (Kalpāvasānikāḥ), who stay in Trailokya and who are proud of their offices (Sthānābhimāninaḥ), knowing that the time of their office had expired and knowing further when the subsequent period (paścimentare) had arrived and when the end was near, that their inevitable end had arrived, put their heart upon (dadhire matiṃ) going to the Maharloka and they went to the Maharloka with their own bodies".

That the Manu, the Saptarṣis and other Gods were public functionaries is shown by the following passage: Vāyupurāṇa 101.23

Maheti vyāhyatenaiva maharlokastatoabhavat I
Vinivṛttādhikārāṇāṃ devānāṃ yatra vai kṣayaḥ II 23 II

"When Brahma uttered the word Mahā, the maharloka came into existence. The maharloka is the abode of gods who have retired from their offices".

As the Manu and the Saptarṣis went in to the Maharloka, the abode of retiring officers, after leaving their places they must be public functionaries. These passages clearly show that the period of office of the Manu and the Rṣis was a Kalpa".

- **Rathanthara Sama**

Daftari goes on to show that Kalpa meant the same period of four years as that of the Manu and a period of 28 Kalpas ending with Bṛhat Kalpa = 112 years constituted Rathantharaṃ, which is described as the largest Maṇḍala of Sun in Vāyupurāṇa 21.77-79. This decipherment of Rathanthara matches well with the number of shining days or "Vidyutaḥ" mentioned in Vāyupurāṇa chapter 50 as:

Catvāriṃśatsahasrāṇi śatānyaṣṭou ca Vidyutaḥ I
Saptatiṃ cāpi tatraiva navatiṃ viddhiniścaye II 180 II

i.e., 40000 + 800 + 70 + 9 = 40879, which is 40907 –28 , where 40907 = 112*365.241 days.

Days of 28 Kalpas = 28*1460 days = 40880; excepting the viṣuvan days [1461-1= 1460] each day of the Kalpa of four years was represented by a letter in the hymns composed in every quarternary. This helps us to identify the 28 Kalpas as 40907 days and a Kalpa as a unit of 1461 days. Daftari further identifies the period of a Mahākalpa as a cycle of 250 Kalpas equal to 1000 years during which the equinox retrogresses by one constellation or nakṣatra and a new Maṇḍala is created.

• Nakṣatra Kalpa or 1000-year Viśvasṛja Sacrifice

Daftari has quoted Tāṇḍyabrāhmaṇā, Chapter25: Khāṇḍa 18:3 & 4 and Vāyupurāṇa II.7 to suggest the prevalence of a count of 1000 years by the public functionaries headed by Brahmā.

Vāyupurāṇa II.7: "In that sacrifice the sun was the sacrificer, the Brahmā (the highest authority in the state) was the Brahmā, the Earth or the public functionary named Iḷā or Irā was the wife and the Death did the duty of Śamitri".

Tāṇḍyabrāhmaṇa Chapter25, Khāṇḍa 18. 4: "The Sun is the sacrificer, Brahmā is the Brahmā, the Earth or the public functionary named Iḷā or Irā, is the Wife, water is the Udgātā, the Past is Prastotā, the Future is Pratihartā, the Seasons are Upagātris, the Truth is the Hota and Ṛta is Maitrāvaruṇa...Nights and Days are Idmawāhas and Death is Śamitā".

• Yugādis according to Prajāpati smṛti

"The 15th tithi of the dark half of the Māgha, the 13th tithi of the dark half of the Nabhasya, i.e., the Bhādrapada, the third tithi of the bright half of the Mādhava, i.e., the Vaiśākha and the ninth tithi of the bright half of the Urja, i.e., the Kārttika, are the beginnings of the Yugas. The Kali began in the Bhādrapada, Dvāpara in the Māgha, Tretā on the third tithi and the Kṛta on the ninth tithi".

Alternative beginning to Kṛta can be found in Mahābhārata, Vanaparva 190:90, where in Mārkaṇḍeya tells Yudhiṣṭira that the Kṛta begins when Sun, Moon and Jupiter are in conjunction on the constellation of Puṣya.

4. Mythology of the Constellations – Vedic Connection

We shall begin with the most popular of all constellations:

(a) Seven Sages (Saptarṣis) or The Great Bear

Hindus have long back forgotten their celestial Bears, but the Vedic literature contains a record of the ancient affiliation of the Bears with the Hindus:

ṚgvedaI.24-10: "These Bears (Ṛkṣa) which appear to be placed high in the sky at night disappears during the day".

Śatapathabrāḥmaṇa II.1-2.4:"The Saptarṣis were called Bears in ancient times".

These solitary references available in the vast mass of Vedic literature when contrasted with the astro-mythological legends of the ancient cultures, we can find a striking resemblance that point towards the origin of these legends in the pre-historic Vedic past of India. Especially we must note here that the Śathapathabrāhmaṇa which itself is of great antiquity mentions the "Bears" as have become obsolete in course of time. In the words of Peter Lum:

"It was in India that the seven stars seem to have been first identified with a bear, an association which is thought to have arisen from a confusion of words. The same root word of the Aryans, "riksha", which meant, "to shine" and was therefore applied to the stars, was also used in a different gender to mean, "bear". The latter meaning gradually became the more common and the original epithet of "shining" was forgotten, so that when men looked up and saw the seven rikshas they believed that these were supposed to be seven bears or, finally, one bear formed out of seven stars. There was a still further confusion when the original "riksha" was confounded with a similar word, "rishi" which meant a sage or poet. In the end Ursa Major was identified with the seven wise men of India, those seven rishis who sailed with Manu in the Ark and thus escaped the universal deluge. The bear was forgotten. But in the mean time the conception of the constellation as a bear had spread westward into other lands and other mythologies and was firmly fixed, having given birth on the way to many and varied legends explaining why the Sky-bear had a long tail, why he never set under the horizon like other stars, why his feet never touched the sea, and how he had ever reached the far north in the first place."

The genesis of Great Bear and the Seven Sages as explained above illustrate the process by which many astronomical mythologies might have taken shape. Even in prehistoric accounts such as in the reference to 'Sages' vis-à-vis 'Bears' in the Śathapathabrāhmaṇa, we can hear of the nomenclature of ancient times as legends of obsolete traditions. How could the ancient Ṛgvedic name and its rationale be lost by the time of the Śathapathabrāhmaṇa? How much time might have elapsed in the transformation of the 'seven shining stars' to the 'Seven Sages' and what might be the antiquity of those original stargazers who have named it with the correct rationale? Is Great Bear an isolated occurrence – what about the nomenclature of other constellations?

It will be easy to relegate the above questions to the background with the presumption that the 'Great Bear' is an isolated occurrence of Indian connection belonging to the remote past, in view of it being circumpolar at latitudes greater than 30^0 in the northern hemisphere. In fact it is not so becomes evident on examining the constellational nomenclature and mythologies of the East and West.

• Mythology of the Great Bear and the Polestar

It was H.Jacobi who first pointed out the reference to polestar as the symbol of steadfastness in the description of marriage rite of the Gṛhyasūtras and made use of it in fixing the antiquity of the custom contained in it. The present polestar, which will have its closest approach to the Pole in 2102 AD, could not have been the source of this tradition. The Dhṛuva who matches with the Vedic antiquity is either Thuban (α-Draconis), which marked the Pole around 2831 BC or ι - Draconis, which was close to the pole around 4800 BC. At these remote epochs the Great Bear or the Seven Sages were closer to the pole and this led to the origin of many legends that inter-relate the Sages with the Dragon

(Draco). The astronomical observations of the above epoch find an echo in many hymns of the Ṛgveda itself.

Ṛgveda I.164-2: "Seven horses are harnessed to that one-wheeled chariot; but only one horse bearing seven names draws it. The wheel has three hubs and it is eternal and unhindered, and all worlds stand supported by it".

I.164-3: "The seven horses mounted on the seven-wheeled car draws them onward as if seven sisters are singing together the names of the seven cows".

The astronomical phenomenon that inspired these hymns can be well understood from the following words of Peter Lum:

"As we have seen, the pole star four thousand years ago was not our pole star but instead was Thuban, a bright star in the tail of Draco. At that time the entire heavens would have appeared to revolve around Thuban, the only fixed point in the sky, as they now appear to revolve around Polaris. It would have been on Thuban that the early stargazers fixed their eyes when they tried to find some center and some order in the spinning universe. The whole of Draco would then have been nearer to the pole as well, coiled in a tight and ever revolving small circle around the north star".

In fact the Seven Sages also would have appeared closer to the pole and would have circumvented it as if seven horses are mounted to the one-wheeled chariot of α-Draconis. α-Draconis had a separate identity in view of its fixity of being Dhṛuva despite its proximity to the Saptarṣis and this is reflected in the words of the Ṛṣi who speaks of the – "only one beyond the Seven-sages" at Ṛgveda X.82.2. Further, substantiation of this idea is available at Taittirīya Āraṇyaka I.7.20, which refers to the 8th Sage Kaśyapā who sticks on to the Mount Meru (North Pole). The word "Kaśyapā" means 'Tortoise' i.e., with the inclusion of the 8th star the Bear got transformed into a Tortoise situated over the pole. The precession or revolution of the polar axis is very slow and akin to the movement of a tortoise and hence the above allegorical title 'Kaśyapā' was given to the 8th Sage or Polestar. The following Ṛgvedic hymn is noteworthy in this context:

Ṛgveda X.22-1: "Where is famed Indra heard of? With what folk is he renowned today as Mitra is-who in the **home of Ṛṣis** and in secret (in the forest- Sāyana) is extolled with song?"

It is well known that the Vedic Indra represents the summer solstice. Equator being perpendicular to the pole the solstices are synonymous with the poles over the ecliptic and hence the above reference to Indra and the 'home of Ṛṣis' simultaneously.

Further at X.22-10: "Urge the heroes to slay the **dragon**, brave thunderer (Indra)... even when hid among the tribes of Sages as numerous as stars"

The slaying of Vṛtra (Ahi) or the Dragon to cause the rains is an astro-mythological allegory of the placement of ι- Draconis at the pole, which corresponds to the summer solstice and the beginning of rainy season. "the tribes of Sages as numerous as stars"

clearly reflect the Seven Sages and the Dragon hiding among them is obviously the polestar ι- or α-Draconis. Similarly, the Ṛgvedic hymn I.32.1-15 speaks of the fight between the rain-god Indra and the Dragon lying on the mountain (Meru or the earth's axis). The relative placement of these stellar characters of Great Bear and Draco in relation to the celestail pole can be understood from the following data:

Stars of Great Bear	Sidereal Ecliptic	
	Longitude	Latitude (N)
Kṛatu (α-Ursa Major)	110^{0}37'	49^{0}41'
Pulaha (β-Ursa Major)	114^{0}51'	45^{0}08
Pulastya (γ-UrsaMajor)	125^{0}53'	47^{0}08'
Atri (δ-Ursa Major)	126^{0}29'	51^{0}39'
Aṅgiraḥ (ε -Ursa Major)	134^{0}21'	54^{0}19'
Vasiṣṭha (ζ-UrsaMajor)	141^{0}07'	56^{0}23'
Marīcī (η-Ursa Major)	152^0 21'	54^{0}23'
Stars of Draco		
λ-Draconis	105^{0}45'	57^{0}14'
κ-Draconis	111^{0}40'	61^{0}46'
α-Draconis	132^{0}52'	66^{0}22'
t-Draconis	160^{0}22'	71^{0}06'
ζ-Draconis	158^{0}48'	84^{0}46'
β-Draconis	227^{0}23'	75^{0}17'
ξ-Draconis	240^{0}10'	80^{0}17'
γ-Draconis	243^{0}23'	74^{0}55'
X-Draconis	231^{0}21'	96^{0}26'

It is apparent that Draco and Great Bear would have been circumpolar at latitudes greater than 30^0 and 45^0 respectively as there would have been no appreciable change in the latitudes of these stars.

- **Associated Purāṇic Legends**

(1) Legend of Nahūṣa

Nahūṣa's reign as Indra and his ride over the Seven-sages to meet Indrani is another related astro-mythological legend. Nahūṣa uttered 'sarpa', 'sarpa' to speed up the Sages and received the curse of Aṅgiras to become a Sarpa or serpent (Dragon). This legend in fact refers to the reign of one of the stars of Draco as the Polestar and its subsequent fall. Reference to Nahūṣa can be found in the Ṛgveda itself and is reflective of the antiquity of the astronomical observations by the Vedic Ṛṣis. Note the cryptic astronomical clue 'Sarpa' that appears in the allegory to stand for the Draco.

(2) Yama as personification of the polestar

As regards Draco, R.H.Allen makes the following comments: " In Persia Draco was Azhdeha, the Man-eating serpent, occasionally transcribed Hashteher; and, in very early Hindu worship, shi-shu-mara, the alligator, or Porpoise, which also has been identified with our Delphinus".

Viṣṇupurāṇa II.9-1 provides concrete justification for the above identification of Draco with "Śiśumāra" and refutes the alleged connection to Delphinus or Makara of the Hindus.

"Tarāmaya bhagavataḥ śiśumārakṛti prabhōh; Divirūpaṃ hareryattu tasya pucchestito Dhṛuvaḥ".

The word 'Śiśumāra' has got a variety of meanings such as –"child killer", the Gangetic porpoise or Dolphin, Delphinus Gangeticus, an alligator, a collection of stars supposed to resemble a Dolphin and held to be a form of Visnu and also as a personification of the father of 'Bhrami' wife of Dhṛuva. The astronomical dimension of the term is well evident from these meanings given in the Sanskrit-English dictionary of M. Monier Williams. Other meanings possible are – Child or little Yama i.e., Yama-kumāraḥ, who was the son of Vivasvan and Śaraṇyu. Ṛgveda X.17-1&2 refers to the birth of Yama as the son Vivasvan

(Sun) and Śaraṇyu. Explicit reference to Yama's location is available at Ṛgveda I.35.6, which speaks of the three heavens - two of Savitar and one of Yama - the home of heroes that remains firm and immortal as on a linch-pin.

Further Ṛgveda X.135.1 to 7 provide a detailed account: "In the tree clothed with godly leaves where Yama drink with the Gods, The Father, Master of the house, tendeth with love our ancient Sires (Seven Sages)".

Ṛgveda X.135.3: " Thou mountest, though *thou does not see*, O child, the new and *wheel-less car* which thou has fashioned mentally, *one-poled but turning every way".*

Ṛgveda X.135.4: " The car, which thou has made to roll hitherward from the Sages, child! This hath the saman followed close, hence, laid together on a ship".

Ṛgveda X.135.5: " Who was the father of the child? Who made the chariot roll away? Who will this day declare to us how the funeral gift was made?"

Ṛgveda X.135.7: " Here is the seat where Yama dwells, that which is called the <u>Home of the Gods</u>: ..."

Especially noteworthy is the fact that 'Kumāra' has made the car "<u>one-poled</u> but turning every way" to roll <u>hitherward from the Sages</u>. Above hymn X.135.5 also explains the origin of the Arabic legend, which consider the Great Bear as 'Mourners' or a funeral procession. R.T.H.Griffith has mentioned the ship placed close as the funeral pile and this is reflective of the Arabic coffin formed by Dubhe (α-Ursa Major), Merak (β-Ursa Major), Phecda (γ-Ursa Major), and Megrez (δ - Ursa Major). Analogues are the western legends that describe the Great Bear as 'Arthur's chariot or Wain ' (England), King David's chariot (Ireland), Wagon (German) etc. Even Homer described them as Great Bear or Wain and R.H. Allen has quoted Miss Clerke to illustrate the genesis:

"We infer, then, that the Babylonian Bear was no other than Ursa Major...Thus circling the globe from the valley of the Ganges to the great lakes of the New world, we find ourselves confronted with the same sign in the northern skies, the relic of some primeval association of ideas, long since extinct. Extinct even in Homer's times".

None of the above legends is as descriptive of the astronomical element as the above hymns which speak of a 'Kumāra turning the chariot counter-clockwise from the sages'. The word 'Kumāra' is an appellation of Dhruva: Ṛgveda I.155-6, has described Sun as 'akumāra' in view of its revolution relative to earth and as such the term refers to the status of being a fixed reference. It is apparent that the use of the term is cryptic and translation of 'Kumāra' as 'child' is not that proper. Also according to the last of the hymns quoted above the seat of Yama is in the 'home of the gods' and this obviously refers to the Mount Meru where sun attains maximum declination.

• Related Legends of Viṣṇu and Indra

Viṣṇu as the son of Kaśyapā and Aditi is another astro-mythological depiction of the phenomenon of precession of the equinoxes. Kasyapa, as we saw above already, has

the Pole as his permanent abode while Aditi represents the ecliptic. Kaśyapā means a tortoise – one of the Avtars of Viṣṇu. Matsya and Varāha also probably arose out of the stellar configurations of Ursae Major, Draconis and Ursae Minor. Peter Lum's description of the Dragon reminds us of the dance of Kṛṣṇa over the head of serpent Kāḷiya:

"The Dragon is certainly a remarkably twisted constellation and it is one which is not so well known as it should be. The tail of the monster lies between the Great and Lesser Bears, his body coils itself with many a star-strewn loop around three sides of the Little Bear and then twists back until a triangle of star forms a wicked-looking, pointed head just below the foot of Hercules..."

Hercules is Kṛṣṇa and Kāḷiya is the Dragon without much of a doubt. Kāḷiya's abode is Yamuna, an allegorical term that implies a co-born of Yama. Kāḷiya may have etymological links with the term Kāla also which stands for Yama and obviously the story has its origin in the polar circle. Clinching evidence is available in the reference towards the 'Kadaṃba' tree from which Kṛṣṇa jumped over Kāḷiya, who had his residence below. 'Kadaṃba' is a well-known astronomical term, meaning - the pole of the ecliptic and thus provides a reassurance for the inference drawn above.

(b) The Dogs of disputed identity

Ṛgveda VII.55.2-3:

"When, O bright son of Sarama, thou showest, tawny hued! Thy teeth, they gleam like lances points within thy mouth when thou wouldst bite; Go thou to sleep. Sarama's Son, retrace thy way: bark at the robber and the thief. At Indra's singers barkest thou? Why dost thou seek to terrify us? Go to sleep.

R.T.H.Griffith has also added the note:"Sarama the hound of Indra, is mother of the two Sārameyas, the brindled watch dogs of Yama, God of the Dead...."

Ṛgveda X.14-10-11:

"Go beyond the two spotted four eyed dogs, the progeny of Sarama and join the wise Pitrs who rejoice fully with Yama. And those two dogs of thine, Yama, the watchers, four-eyed, who look on Men and guard the pathway...."

Same ideas could be found at Atharvaveda XVIII.11-12 and regarding the astronomical import of these hymns Sengupta says:

"These two dogs we take to have been the two stars α-Canis minoris and α-Canis majoris. The astronomical interpretation becomes that there was a time, there was a time Vedic or pre-Vedic, when these two stars pointed to the south celestial pole, i.e., at that time these two stars crossed the meridian simultaneously or they had the same right ascension..."

Accordingly he has determined the age of the hymns to be around 4350 BC. Sengupta has remarked further that:

"All these constellations viz., the two dogs and the Argo Navis are to be found not only in the Vedas, but also in Greek and the Parsi Mythology. While in the Hindu literature these constellations were forgotten and called by other names, for example Canis Majoris by Lubdhaka (the Hunter) and Canis Minoris by a star of the naksatra Punarvasu and the Argonavis is quite lost sight of in the Hindu literature, the constellations are still used and so named in western astronomy. The names of the two dogs of Yama are preserved in the Zendavesta. In the Parsi legend these two dogs 'keep the Kinvat Bridge' as imagined to have been made over the Milky Way. In the Greek legend a ferryboat, the Argonavis, is available to cross the Milky Way. All these considerations lead us to think that the tradition about Yama's Dogs, belong to the date of about 4700 BC and before the time when the Aryan peoples migrated to different countries from their ancient homes. This ancient tradition in relation to the above constellations survived in the Vedas and with western immigrants..."

A.J.Karandikar has disputed the above identification of the Dog with Canis...on the following lines:

Ṛgveda I.161.13:

"The Ṛbhus woke up from their sleep and asked Savita, 'O, revealer of secrets, tell us who has awakened us'. At that time a goat shouted, 'O, the year has come to the end and therefore the dog has awakened you".

This statement from the Ṛgveda is considered to be very decisive in the determination of the Vedic Calendar. Tilak, P.C.Sengupta and other Vedic astronomers have suggested that the 'dog' in the above stanza must be one of the twin-stars known as the 'hunder'. According to us this inference is not correct. Our suggestion is as follows: In the Greek mythology there is a story of the prime man who prepared wine. This man was killed by his neighbor and buried in the earth. The story tells us that the dog of the man showed his daughter the place where he was buried. The earth was dug out and the corpse of the murdered man was recovered. The miserable daughter strangled herself

to death. The poor dog who had witnessed his masters sad deaths also died in grief. The Gods rewarded the daughter and the dog by placing them permanently in the firmament amongst the constellations. This story can be very well explained in astronomical terms. The Ṛbhus had gone to sleep when the Sun was in the mansion of Hasta-Corvis. Nearabout there was a constellation of Kanyā and a star. This star came to be called the 'Dog star'. Dr.Shyamshastri in his 'The Vedas and the Planets' has shown how the Phalguni could be fittingly called the 'Shvana' or the dog. He notes:" As each of the two Phalgunis is compared to four eyes for facility of identification in the list of the 27 asterisms, the two Śarama-Dogs must necessarily represent the two Phālgunis". The story of Kālakañja in the Taittirīya Brāhmaṇa intervenes in the description of the constellations of Uttara Phālguni and Citrā. It therefore strikes us, that the Kalakanja who turned to be the divine dogs must be somewhere near this region. This guess is supported by the belief in the Babylonian tradition. Robert brown in his 'Primitive Constellations' observes:

"In the Eupheretian sphere it seemed that the figure of a dog was placed behind the lion and flying from the latter fearing lest it should turn round. Agreeably with this we find the XIIIth Arabian Manzil (Lunar Mansion) is called 'Al-Aluwa' (the Howler), and smyth speaking of Virginis says, 'Piazzi' calls it Zavijava, the retreat of the barker. Ulugh Beigh has it Min-Al-Auwa i.e. the 'stars of the barker', or the 'barking bitch'. The dog was not a separate constellation but was included in the lion".

Do you know who this bitch was? She is 'Sarama' of the Vedic legend...."

On the ecliptic these different candidates are situated at:

Star	Sidereal λ	Latitude
α-Canis Major (Sirius)	$79^0 30'$	(-) $39^0 36'$
α-Canis Minor (Procyon)	$91^0 12'$	(+) $16^0 01'$
δ-Leonis (P. Phālguni)	$136^0 44'$	$14^0 20'$
θ-Leonis	$138^0 50'$	$09^0 40'$
93-Leonis (U.Phālguni)	$144^0 23'$	$17^0 19'$
β-Leonis	$147^0 02'$	$12^0 16'$
β-Virginis (Barking Dog)	$152^0 35'$	$00^0 44'$
ε-Virginis (Vindemiatrix)	$165^0 21'$	$16^0 12'$

To Egyptians, Sirius and Procyon (preceding the dog) was the first and second hound of 'Orion the Hunter' and they stood on either side of the Milky Way. In 400 BC, the heliacal rising of Sirius marked the entry of Sun into Leo and the hottest season of the year and thus the mid-summer days came to be known as 'dog days'. Like some of the Indian scholars R.H.Allen has also identified Sirius with Sarama of Indian pre-historic legends who is one of the Twin watchdogs of the Milky Way. But these watch dogs do not have the appellation of 'Barker' and Allen himself has identified, β-Virginis as the Barker. In the light of Karandikar's observations quoted above it is quite likely that we have got two sets of 'Dogs' on the celestial vault rather than a single. Undoubtedly the Dogs related to the Milky Way can only be the Canis Major & Minor and the heliacal rising of these western dogs probably marked the solar transit over the southern ones holding the solstice and this led to the common appellation of 'Dog' for both the pairs along with the 'Yama' connection. Another possibility may be the different conceptions of Pitṛloka related to the autumnal equinox and the summer solstice as explained below.

• Conflicting Conceptions about Pitṛloka

Tilak has given the correct astronomical interpretation for Devayāna and Pitṛyāna as the northern and southern halves of the celestial sphere. Sengupta has criticized Tilak's view on the following lines:

"We are here concerned with the faith about their (Pitṛs) place of abode and of their Lord Yama. On this point the Śatapatha Brāhmaṇa (XII.7.3.7) says:

"Two worlds in truth there are, they say, the 'world of the Gods' and the 'world of the Fathers' (Pitrs)".

"The world of the gods is in the north and the world of the fathers (Pitṛs) in the south"

Thus the Pitṛs live in the south; consequently their Lord Yama must also be a dweller of south. In a modern Sanskrit dictionary, Yama is defined to be 'a god appointed by the Supreme Lord for deciding the destinies of departed souls according to their good or bad deeds in this world of ours, and is stationed in the south'. In the Mahābhārata, Vanaparva, in the story of Sāvitri, it is said that 'Yama having bound the soul of Satyavan went southward'. In another Sanskrit Dictionary Yama is defined as 'the lord of the southern direction'. Hence according to the Hindu faith both Yama and his subjects, the Pitrs, are dwellers of south. The Sanskrit word 'Yāmya' meaning the south, is derived from Yama, the lord of the south. The Hindu when offering libations to his fathers, has to turn to the south and invoke them by the following verse:

"Our fathers, the Saumyas and the Agniṣvāttas come by the Devayāna route (northward direction) be delighted at the sacrifice by enjoying our offering (Svadhā) and bless us. May they protect us"

There are the two routes spoken of in the Hindu sacred lore, the one is the Devayāna and the other the Pitryāna, respectively the route of the gods and the route of the fathers. When the fathers come, they come by the Devayāna route and when they go back, they certainly follow the Pitryāna route. Thus both the routes may lie on the same meridian, the former is the northward direction and the latter the southward direction. Here we have to differ from Tilak who in the book Orion would interpret that Devayana route is the part of the ecliptic lying north of the celestial equator and the Pitryana route, the part of the ecliptic south of the celestial equator. His interpretation appears to be unjustifiable and incorrect, as the Fathers who come from the south do follow according to the Hindu faith the Devayāna route. When men die they follow according to Hindu faith the Pitṛyāna route or the southern direction. In this route to the abode of Yama, lay two dogs which were both 'spotted four-eyed dogs'...."

The routes of the Pitṛs and Gods are different from their abodes. The astro-mythological conception of their abodes is more fundamental than the conception of their routes and there was no need to mix up these different conceptions. Sengupta in fact criticized Tilak without explaining the factors that inspired Tilak to frame his hypothesis. To quote:

• Tilak's Conception of the Abode of Yama

"The Vedāñga Jyotiṣa makes the year commence with the winter solstice, and there are passages, in the Śrautasūtras which lay down that the annual sacrifices like gavāmayana, should be begun at the same time. A tradition has also been recorded by Jaimini and others that all Deva ceremonies should be performed only during the Uttarāyana; and the Uttarāyana, according to the several Jyotiṣa works, is the period of the year from the winter to the summer solstice, that is, from the time when the sun turns towards the north till it returns towards south. This leads one to suppose that the winter solstice was the beginning of the year and also of the Uttarayana at the time when the annual sacrifices were established, and therefore in the old Vedic days. But a closer consideration of the ceremonies performed in the yearly satras will show that the winter solstice could not have been the original beginning of these satras. The middle day of the annual satra is called the Viṣuvan day, and it is expressly stated that this central day divides the satra into two equal halves in the same way as the Viṣuvan or equinoctial day divides the year. The satra was thus the imitation of the year in every respect, and originally it must have corresponded exactly with the course of the year. Now, as Viṣuvan literally means the time when day and night are of equal length, if suppose the year to have at the time commenced with the winter solstice, the Viṣuvan or the equinoctial day could never have been its central day, and the middle day of the satra would correspond not with the equinoctial, as it should but with the summer solstice. It might be urged that Viṣuvan as referring to the satra should be supposed to be used in a secondary sense. But this does not solve the difficulty. It presupposes that Viṣuvan must have been used at one time in the primary sense (i.e., denoting the time when day and night are equal), and if in its primary sense it was not used with reference to the satra it must have been so used at least with reference to the year. But if Viṣuvan was thus the central day of the year, the year must have once commenced with the equinoxes. The word Uttarāyana is again susceptible of two interpretations. It may mean "turning towards the north from the southernmost point", or it may indicate "the passage of the sun into the northern hemisphere, i.e. to the north of the equator". If we adopt the first meaning, the Uttarāyana and the year must be held to commence from the winter solstice, while if the second interpretation be correct, the Uttarāyana and the year must have once commenced with the vernal equinox. The facts, that the central day of the annual satra was called Viṣuvan, that Vasanta or spring was considered to be the first of the seasons, and that the agrayaneshtis or the half yearly sacrifices were required to be performed every Vasanta (spring) or Śarad (autumn) clearly show that the second of the two interpretations given above is more likely to be the older one. Let us however, examine the point more fully.

The only passage where Uttarāyana is mentioned in the Vedic works are those wherein the white and the black paths for the souls of the diseased, the Devayāna and the Pitṛyāna, are described. The words Devayāna and Pitṛyāna occur several times in the Ṛgveda. Agni is said to know both these; while in the Vājasaneyī Saṃhitā 19.47, these are said to be the two paths open to mortals. In the Ṛgveda X.18.1, the path of the god of death is said to be the reverse of Devayāna, and in the Ṛgveda X.98.11, Agni is said to know devayana by seasons. There is, however no passage in the Ṛgveda where devayana is fully defined and we have consequently to refer to the passages in the Bṛhadāraṇyaka and the Candogya Upaniṣads for a fuller explanation of these terms. Before the idea was recorded in these works it must undoubtedly have received considerable additions, but nevertheless the original sense cannot be supposed to have been completely lost in these later additions. It is therefore extremely important to see how these two paths are described in the Brāhmaṇas and Upaniṣads. Brih.2, 15 and Chh.IV.15.5 state that "flame, day, the increasing moon, the six months when the sun is towards the North, the Devaloka (Chh. devapatha) or the abode of gods, etc." is the way never to return; while "smoke, night, the decreasing moon and the six months when the sun is towards the south, the Pitrloka or the abode of Pitrs" is the reverse. In the Bhagavadgīta VII.24, 25 we find the same sentiments in modern phraseology and the question is, what is meant by the phrase "the six months when the sun is towards the north" or, as Yaska and

Gita have it, "the six months of the Uttarayana". Almost all the commentators have interpreted the expression to mean the six months from the winter to the summer solstice. But notwithstanding their higher authority it will be found that their interpretation, though in consonance with the later astronomical views, is directly opposed to the passages in the Vedic works. In the Taittirīya Saṃhitā VI.5.3, we are told " the sun, therefore, goes by the four six months and six by the north". But this does not help us in ascertaining the correct meaning of the phrase "by the north". As it stands it may mean either the solstitial or equinoctial six months. We must therefore look for another passage and this we find in the Śatapathabrāhmaṇa (II.1.3,1-3), where in describing the two aforesaid paths it lays down in distinct terms that Vasanta, Grīṣma and Varṣa are the seasons of the Devas; Śarad, Hemanta and Śiśira those of the Pitṛs; the increasing fortnight is of Devas; the decreasing one of the Pitṛs: the day is of the Devas; the night of the Pitṛs: again the first part of the day is of the Devas; the latter of the Pitṛs...When he (the sun) turns to the north, he is amongst the Devas and protects them; when he turns to the south he is amongst the Pitṛs and protects them". This removes all doubts as to what we are to understand by devayana, devapatha, or devalok and Uttarayana as connected with it. The Bṛhadāraṇyaka Upaniṣad is a part of the Śathapathabrāhmaṇa, and we shall not be violating any rule of interpretation if we interpret the passage in the one in the light of a similar passage in the other. Now if Vasanta (spring), Grīṣma (summer) and Varṣa (rains) were the seasons of the Devas and the sun moved amongst the Devas when he turned to the north, it is impossible to maintain that the Devayāna or the Uttarāyana ever commenced with the winter solstice, for in neither hemisphere the winter solstice marks the beginning of spring, the first of the Deva seasons. The seasons in Central Asia and India differ. Thus the rains in India commence about or after the summer solstice, while in the plains of Asia the season occurs about the autumnal equinox. But in neither case Vasanta (spring) commences with

the winter solstice or Varṣa (rains) ends at the summer solstice. We must, therefore, hold that Devayāna in those days was understood to extend over the six months of the year, which comprised the three seasons of spring, summer and rains, i.e. from the vernal to the autumnal equinox, when the sun was in the northern hemisphere or to the north of the equator. This shows further that the oldest order of seasons did not place Varṣa (rains) at the summer solstice, when the chief Indian monsoon commences, but at the autumnal equinox. The winter solstice according to this order, falls in the middle of Hemanta. In the modern astronomical works, the winter solstice is, however, placed at the end and not in the middle of Hemanta, while the vernal equinox is said to fall in the middle of Vasanta. When the Vedic Aryans became settled in India, such a change in the old order of seasons was necessary to make them correspond with the real aspect of nature. But it is difficult to determine exactly when this change was made. The old order of seasons given in the passage above quoted, however, clearly states that Vasanta in old days commenced with the vernal equinox. We can now understand why Vasanta has been spoken of as the first season and why the Nakṣatras have been divided into two groups called the Deva Nakṣatras and the Yama Nakṣatras....

It is difficult to definitely ascertain the time when the commencement of the year was changed from the vernal equinox to the winter solstice. But the change must have been introduced long before the vernal equinox was in the Kṛttikās, and when this change was made Uttarāyana must have gradually come to denote the first half of the new year, i.e. the period from the winter to the summer solstice, especially as the word itself was capable of being understood in the sense of "turning towards the north from the southernmost point".... (p.21) After a certain period the beginning of the year was changed to the winter solstice, and it was some time after this change was made that the words Uttarāyana and Dakṣiṇāyana came to be used to denote the solstitial divisions of the year. But devayāna and pitṛyāna could not be at once divested of the ideas, which had already become associated with them. Thus while new feasts and sacrifices came to be regulated according to uttarāyana and dakṣiṇāyana, devayāna and pitṛyāna with all the associated ideas continued to exist by the side of the new system, until they became either gradually assimilated with the new system....(p.23) With the year the beginning of the annual satras was also gradually transferred to

the winter solstice and the change was complete when the 'Taittirīya Saṃhitā' was compiled. In fact had it not been for the passage in the Śatapathabrāhmaṇa it would have been impossible to produce any direct evidence of the older practice. When the beginning of the satra was thus changed, the Viṣuvan day must have gradually lost primary meaning and come to denote simply the central day of the yearly satra.

The old practice was not however completely forgotten and for the purpose of the Nakṣatra-sacrifices the vernal equinox was still taken as the starting point. Thus it is that Garga tells that "of all the Nakṣatras the Kṛttikās are said to be the first for sacrificial purposes and Śraviṣṭhā for (civil) enumeration". But even this discrimination appears to have been eventually lost sight of by the later writers and all references to Uttarāyana were understood to be made solely to the six months from the winter to the summer solstice, an error from which even Bhaskarācārya did not escape, though he perceived the absurdity caused by it in some cases. At the present day we on the southern side of the Narmada begin the year at the vernal equinox for all Civil purposes, but still all the religious ceremonies prescribed to be performed in the Uttarāyana, are performed during the Uttarāyana beginning with the winter solstice, a position quite the reverse of that described by Garga...."

Further at page 32 of 'The Orion' we can find the elaboration:

"In the Taittirīya Brāhmaṇa (I.5.2.7) it is stated that "the Nakṣatras are the houses of gods...the Nakṣatras of the Devas begin with the Kṛttikās and end with Viśākha, whereas the Nakṣatras of Yama begin with the Anuradhas and end with the Apa-bharaṇis". ...the sun moved amongst the Devas...all the Nakṣatras in the northern hemisphere, from the vernal to the autumnal equinox,

would naturally be called the Nakṣatras of the Devas. Now the southern hemisphere was assigned to the Pitṛs; but I have already quoted a passage from the Ṛgveda, which states that it was the path of the god of death. In Ṛgveda X .14.1, Yama is spoken of as the king of Pitṛs and in verse 7of the same hymn the deseased is told to go to the pitrloka where he would meet the god Yama. In the Vājasaneyī Saṃhitā 19.45, salutation is made to the world of Pitṛs in the Kingdom of Yama. There are many other passages of similar import in the Saṃhitās, and from all these it would be clear that the Pitṛyana or Pitṛloka was also called the kingdom of Yama. The Nakṣatras in the southern hemisphere, therefore, came to be designated as the Nakṣatras of Yama in opposition to the Nakṣatras of the Devas, thus dividing the whole circle of stars in two equal groups. This also explains why Yama is made to preside over the Apa-Bharanis. It was at the Apabharaṇis that the zodiac was divided, the Kṛttikās going over to the Devas, and Apabharaṇis turning down into the Yama's portion of the celestial hemisphere".

Also at page 69:

"I have already mentioned before that the year was divided into two ayanas, the northern and the southern and that though originally the northern ayana indicated the passage of the sun to the north of the equator yet it afterwards came to indicate the passage of the sun from the winter to the summer solstice. I have also stated that after this change was made all the attributes of the older ayanas must have been gradually transferred to the new ones, though the old division was concurrently kept up and that the new ideas were formed solely with reference to the solstitial division of the year. Thus the Pitṛyāna during which time the sun in older times went down the equator must have come to be regarded, for some purposes at least, as commencing from the summer solstice. With winter solstice occurring on the Phālguni fullmoon day, we shall have the summer solstice on the Bhādrapadi fullmoon, so that the dark half of Bhādrapada was the first fortnight in the Pitṛyāna, understood as commencing on the summer solstice. It was thus pre-eminently the fortnight of the Pitṛs or the manes; and to this day, every Hindu celebrates the feast to

the manes in this fortnight. As far as I know no reason has yet been advanced why the dark half of Bhādrapada should be called the fortnight of the Pitṛs (Pitṛpakṣa) and why special feast to the manes should be ordained at this particular period of the year. With the winter solstice in the asterism of Uttara-Bhadrapada, that is, when it occurred on the Phālguni fullmoon the matter is simply and satisfactorily explained. For then the Dakshinayana or summer solstice commenced on the dark half of Bhadrapada and this fortnight therefore naturally became the first fortnight in the ayana of the manes".

It is apparent from the above that according to Tilak, the kingdom of Yama had two different beginnings viz., autumnal equinox and summer solstice in the Vedic conceptions respectively of an earlier and later period. As against this view the present author would like to present a slightly different picture with reference to the sidereal zodiac. In fact the real configuration of the two domains of the Devas and Pitrs can be understood only with reference to the fixed zodiac having Mūla as fiducial at 240^0. In 4137 BC, the autumnal equinox fell over Mula and thus marked the beginning of Yamaloka consisting of the six zodiacal signs from Sagittarius to Taurus. It must be noted here that the deity of Mūla is Nirṛti or death. Mūla being at the point where the galaxy cuts the ecliptic across 60^0 – 240^0, Ākāśa Gaṅgā became the boundary that separated the Pitṛloka from the Devaloka and also the path of the Pitṛs to reach the kingdom of Yama. It was in this conception that the Canis Major and Canis Minor became the dogs overlooking the path of Yama. On the other hand when the summer solstice came to be regarded as the beginning of Yama's path, the two Phālgunis took over the mantle of Dogs and β-Virginis became their mother Sarama. Remnants of these differing practices can be found in the present day observances of Mahālayapakṣa in the dark fortnights of both Bhādrapada as well as

Aśvina. Bhādrapada and Aśvina respectively are the redundant traditions related to the summer solstice and autumnal equinox.

The following inferences of Tilak are supportive of the above identification of the Dogs:

(a) "Greek astronomy places two dogs in this part of the heavens – Canis Major and Canis Minor – one on each side of the Milky Way, and it has been doubted whether the claims of these dogs to primitive antiquity are well founded. In what follows, I hope to show that they are...."

(b) "Ordinarily the Pitṛyāna is described (Ṛgveda IX.113.8) as the region 'where Vaivasvata is the king, which is the undermost (lit. obstructed) part of the heavens, and where there are eternal waters'.

(c) "Thus the Devayāna and the Pitṛyāna, as representing the two hemispheres must be joined, and the vernal and the autumnal equinoxes became the natural points of union between the regions of gods and Yama. The equinoxes were, in fact, the gates of heaven, and as such it was natural to suppose that they were watched by dogs. In the Ṛgveda I.48.15 the dawn is spoken of as illuminating the 'gates of heaven' and in I.13.6 and II.3.5 the gates-deities are invoked to keep the gates open. We have a similar invocation in the Vājasaneyī Saṃhitā 21.49. This shows that the idea of the 'gates of heaven' was not unknown in Vedic times and the arrangement of the gates on the sacrificial ground, which is prepared on the model of the annual passage of the sun, shows that these gates divided the whole hemisphere into two parts. Macrobius records a tradition that 'the ancients designated the signs of Cancer and Capricorn as the gates of the sun, at which having arrived, the luminary seemed to retrace his path in the zone which he never leaves'...(P.82, 'The Orion') The Iranians, however, have preserved the legend more fully. With them the equinox is not merely a gate, but a bridge connecting heaven and hell – the Devaloka and the Yamaloka, or the

Devayāna and the Pitryana – and 'dogs that keep the Chinvat Bridge' help the departing soul to cross it... According to Bundahis XII.7, the Chinvat Bridge extends from the height of Chakad-i-Daitak in the middle of the world to the summit of Arezur at the gate of hell; while Dr.Geiger observes that 'it was believed to have been built over a wide expanse of water which separates the paradise from this world'. In the later Indian literature we are told that the souls of the diseased have to cross a stream before they reach the region of Yama, while the story of Charon shows that the Greeks entertained a similar belief. What could this river be? With the vernal equinox in Orion, one can easily identify it with the Milky Way, which could then have been appropriately described as separating the regions of gods and Yama...".

(c) Argo Navis – the Celestial Ship

The ship Argo lies in the southern hemisphere east of Canis Minor. RH Allen refers to it as the ship Argha of wandering sun steered by Agastya (Canopus or α-Carinae) and says:

"In this Sanskrit 'argha' we perhaps may see our title".

About the southern stars in general Peter Lum makes the following observations:

"*These are the stars that we who happen to live in the Northern Hemisphere never see. In some cases they were higher in the sky and visible from further north several thousands of years ago than they are now, but on the whole they were also comparatively unknown to those ancient civilizations from whom we have inherited our mythology and astronomy, so that legends about them are fewer than those of the great northern and equatorial constellations, and are limited to countries situated either in the Southern Hemisphere or at least fairly near the equator. Some of the older southern constellations were named and known in early times by the Indians, Egyptians and Greeks, who saw them rise for a brief space above the horizon before they disappeared again*".

According to Greek legends the ship Argo was built by a son of the sea god Poseidon and Hindus have got a strikingly similar legend about the helmsman of the ship Agastya, who is the son of Varuna(God of the seas). As regards the originators of these legends India, Egypt and Greece are contenders but the evidence of the Ṛgveda tilt the balance in favour of India. Ṛgveda (X.63.10) speaks of 'the well oared heavenly ship that let no waters in, free from defect, will we ascend for happiness' and Agastya or Canopus is one of the most prominent of Hindu seers who is supposed to have moved over and settled in the south.

(d) Dhanus or The Archer (Sagittarius)

Hindus have very nearly forgotten the astronomical roots of their mythological heroes and the Archer is a fine example of this forgetfulness like the celestial Bears who became Sages in course of time. As the present author has come to understand it was A.J.Karandikar who in modern times has attempted to resurrect the mythological connotations associated with this constellation. Karandikar has identified the principal star Mūlabarhiṇī (λ-Scorpii) with Rudra of Vedic mythology and also with the great captains of

Asura / Rākṣas brigade such as Namuci, Rāvaṇa, Kaṃsa, Vṛtra etc. To quote Karandikar:

"The sign of Dhanu-Sagittarius was the origin of the concept of Rudra. Now that the constellation Mula can be identified as the original form of Rudra it becomes apparent why Rudra became the Lord of the constellation Ārdṛa – Betelgueze, which is in opposition to the Mūla. In the Vedic tradition Visnu is considered to be the Lord of the constellation Śṛāvaṇa – Altair (α-Aquilae), which also appears in the form of Kaśyapa Prajāpati as the Lord of the Puṣya – the 'Crab Bee'.In the Atharvaveda (II.8.1), the poet sings a hymn praying for his liberation from the noose of a disease cast by Namuci, which was difficult to be remedied. In the above hymn the twin stars 'Vichrutau' are addressed as 'Bhagavati'. As a result of this respectable epithet – 'Bhagavati', the twin stars Vichrutau came to be presented in the form of half-man and half-woman concept of the progenitors of the universe and addressed as the parents of the world 'Jagataḥ Pitarau'. The unbreakable bow of Śiva is of course the sign of Dhanu – Sagittarius. A legend in the Kathak Saṃhitā states that the Gods had created an unbreakable bow. But only Rudra the most powerful amongst them could wield and use it to vanquish the enemy. They therefore made him the Lord of the 'animal world' for seven days and urged on him to take up the bow. Mark well – the mention of 'Seven days' in this place, which convincingly establishes that at the time when famous Rudra hymn was sung, the 'seven days' week and the luminaries after which they were named had come in vogue in everyday life*".

Further, we can find:

"...Our common belief is that Rudra is the star known as Vyādha – the Archer or Hunter – in the sky. Harivaṃśa, however, gives a better identifiable description of Rudra. It says:"In old times Rudra stood in the battle field with the bow and arrows given to him by the Svayaṃbhū – self born. The Mahādeva took the bow, bent his knee on the ground, put an arrow to the string and shot it at the 'Yajña' – sacrifice. The 'Yajña' – sacrifice that was smitten by the arrow flew in the sky. It took the form of a deer or Mṛga. Wailing loudly, the deer proceeded to Brahmadeva. The Brahmadeva pacifying the injured deer said:" You will stay in the sky permanently in this form of a deer. You have been vanquished by an arrow with three parts with its end bent. You will stand in this very pose at the head of the constellations with the great Archer, Rudra, at your back. May you be united for ever with the eternal and inexhaustible Moon, in the company of stars, and move forever in the sky".

I beg to differ a little from the interpretations that identify Vyādha as the Rudra. Rudra placed on the rear of the slain Mṛga is in fact Mūla and as pointed out by Karandikar the description of Rudra quoted above from Harivaṃśa has an uncanny resemblance to the western conception of Hercules the Kneeler. The theory of sidereal zodiac or Mūlādhāra Cakra presented in section V is also corroborative of the Mūla's mythological identity as Mahādeva-Rudra or Mahākāla. Rudra is Gaṅgādhara, Mūla being placed at the point where Ākāśa Gaṅgā cuts the ecliptic and also he is the Preceptor of Jyotiṣa and Yoga, the super-sciences based on the Mūlādhāra Rāhu-Śikhi Cakra. Mūla-Rudra is the fulcrum about which the symbolic equivalence and harmony between the microcosm and

* Rudra is more correctly the deity presiding over Ārdra rather than its lord.

macrocosm is maintained and as Dhanvantari he presides over the world of medicines, cure, as well as life eternal. An echo of this description of Rudra can be found in the western profile of Chiron as available in the work of Peter Lum:

Wisest beyond the men of his day, wiser even than most of the gods, Chiron was especially skilled in medicine, in music and in hunting...It was Chiron who supposedly invented the constellations, tracing out their golden lines for the first time on the sphere of heaven so that they should be an everlasting guide man. Before that time the stars had been confused and no one knew how they were placed, or what they meant, or how to use them. But when the genius of Chiron had pointed out the shapes to be seen in the stars and divided them into orderly groups, then people could read the skies as though they were a book specially written for mankind, could find in them the heroes of many an ancient legend, and above all, could foretell the seasons by the passing of the stars".

Mūla as the fiducial star of the Hindu zodiac is obviously the sculptor who has carved out the constellations and thus fits the description of Chiron very well. Identification of Mūla as Rudra receives support from the neighboring star group of Sagitta, the arrow, which is referred to as the "Arrow of Cupid" by RH Allen. The present author is not aware of the ancient source of Allen's information, but it is most likely that the legend originated in India where the story of Cupid targeting Mahādeva-Rudra is very popular at least since the time of Kāḷidāsa. Similar is the case with Ophiuchus, the Serpent Bearer (lying on the west), in whom we can find a reflection of the figure of Sarpadhāri Śiva.

In the context of zodiac the astronomical origin of the mythology of Rudra and Durga will be discussed in detail.

(e) Kanyā, Virgin of the Zodiac

Karandikar has quoted the following legend from the Mahābhārata, Vanaparva Chapter 192, which contains the symbolism of the sign Virgo. Mārkaṇḍeya has spoken the story involving Parīkṣit, a King of Ayodhya, to Yudhiṣṭiraḥ to illustrate the greatness of Vāmadeva Ṛṣi. Parīkṣit while hunting in the forest came across a Virgin on the bank of a beautiful lake. The Virgin agrees to marry him on the condition that she won't be taken near water. Duped by the minister, King unknowingly takes her to a lake one day and she disappeared by assuming the form of a frog. The astronomical interpretation given to the story is that with the approach of summer solstice, the sign of the Virgin came to be looked upon as a Maṇḍūka Kanyā or Pḷavaga and the time frame involved is 5000 – 6000 BC. The most striking aspect is the term 'Pḷavaga' meaning a frog, by which the sign Kanya is known even in the comparatively modern times of Varāhamihira.

To prove the existence of zodiacal signs in Vedic times, Karandikar has quoted Ṛgveda IX.87.9:"You (Soma) travel through Rāśis – the signs, 'Gonam' – the cows; Soma along with Indra in a chariot". Also Karandikar interprets the Vedic reference to the 'Daughter of Sun' as indicative of the sign Kanyā.

A detailed discussion on the mythological appearance of Kanyā as Durga is available in the context of sidereal zodiac.

(f) Milky Way or Kṣīrapathaṃ (Ākāśa Gaṅgā)

In the words of Peter Lum:

"*It varies in width and brightness in different parts of the heavens, the richest clusters of light being in Sagittarius in the Southern Hemisphere and in Perseus and Cygnus in the north, but it remains always constant in its position relative to the stars. It forms a band, which completely circles the sky. Following its course from the north-polar regions, it flows through Cassiopeia and under the feet of Perseus, just touches the horns of Taurus, separates Orion from the Twins and thence between the two Dog stars runs into Argo, skirts round the Southern Cross, swings north again through Scorpio and Sagittarius, Aquila, Cygnus, and so once more to Cassiopeia*".

Most of the ancient civilizations have considered the starry band as an Ocean Stream, River of Stars or a Great Serpent. Babylonians and Mongols consider it as the joint of the celestial hemispheres. Hindu beliefs are also strikingly similar: The greatest of the Hindu Trinity, Viṣṇu, sleeps over the Milky Way on the great serpent Ananta. Many of the Hindu gods like Lakṣmi and Moon had their birth from this celestial Ganges (Kṣīrasāgaraṃ) that was churned for the elixir (amṛtaṃ) by the Devas and Asuras together. According to Umāpāda Sen the Ṛgvedic Sindhu in fact is the celestial river rather than the terrestrial Indus as is generally interpreted. Ṛgveda X.75.7:" Sprinkling bright with mighty splendour, she carries the water across the plains, the unconquered Sindhu, the quickest of the quick, like a beautiful mare, a sight to see". Sen has criticized this Maxmuller translation

with the remark that 'there is nothing in the verse to suggest *carrying of water across the plains*'. He drives his point well by quoting in support of his contention the interpretations of Langlois and Ludvig and adds:

"*This Sindhu is therefore a delight to the eyes, it appears such and such to eyes and all the translators agree to this; and this object of delight is the Galaxy over head, a spotted foal, unhindered and whitish. A reading of the translations is more than enough to make one realize that the characteristics attributed to Sindhu do not refer, can not refer to any stream on land but to another category of river which the poet had referred in the beginning, the celestial stream, and it is the milky way in the night sky and not the river Indus*".

With reference to the hymn X.78.6, Sen observes:

"Long ago, it was discussed by Max Muller and other competent scholars, "Sindhumātaraḥ and Pṛṣṇimātaraḥ are synonymous and Sindhu has been used as a *river in the sky*". Bergaigne translates...- We have for mother the celestial river. This river perhaps is one of the forms of cow (forget cows, they by all means relate to the rays of light and here the galaxy), which stands (goes) for their (Maruts') mother. X.78.6 conclusively shows that Sindhu was a river in the sky. What is a river in the sky, which is white in colour, spotted with stars, whose banks are tinged with golden hue, which flows unhindered, straight, which is nowhere obstructed and which is a delight to the eyes. Can anyone on earth, can any sensible person deny that it is nothing but the Milky Way?"

(g) Identity of Ṛgvedic 'Soma'

Perhaps no other concept pauses so much difficulty of interpretation as the Soma referred to in Ṛgveda. Soma despite being a popular epithet of Candraḥ, most of the commentators have found favor with the interpretation that it refers to a variety of the Ephedra plant, which on pressing yielded an exhilarating drink. Kochhar gives the following account about Soma:

"Soma is a celebrated plant in the Ṛgveda as well as in the Avesta, where it is called Haoma, later shortened to Hom in Pahalvi. A drink of the same name was extracted from the plant by pressing or crushing its stalk, for offering to the gods and for drinking. (The name Soma comes from the root su, "to squeeze".) The Soma cult's significance is apparent from the fact that the Ṛgveda devotes a full maṇḍala to it. The longest hymn in the Ṛgveda (Ṛv 9.97) is addressed to it".

A sweeping identification as the above with 'Ephedra' without giving due consideration to the claims of Moon may not stand the test of scrutiny in the light of the descriptions available in various hymns. Had the matter been so simple as to allow a straight forward identification, RTH Griffith would not have been in so much confusion as to pen down the following lines:

"Nearly all the hymns of this book are addressed to the deified Soma juice, or to Soma, or Indu, the Moon, who as containing the celestial nectar, the drink of the Gods, is identified with the Soma-plant and its exhilarating juice. As the Moon-God pours down his ambrosial rain through the sieve of heaven, he is addressed and worshipped as

Pavamāna (Self-Purifying), represented by the Soma juice as it undergoes purification by flowing through the wool which is used as a filter or strainer".

It is true that the hymns of IXth maṇḍala do not provide an explicit identification of Soma as Moon. But the hymn X.85 leaves no room for any doubt as regards the true identity of Soma:

Ṛk X.85.1:"Truth is the base that bears the earth; by Sūrya are the heavens sustained. By Law the Ādityas stand secure, and Soma holds his place in heaven".

Ṛk X.85.2: "By Soma are the Ādityas strong, by Soma mighty is the earth. Thus Soma in the midst of all these constellations hath his place".

Ṛk X.85.5: " When they begin to drink thee then, O God, thou swellest out again. Vāyu is Soma's guardian God. The Moon is that which shapes the years. (RTH Griffith)

In explanation of X.85.2, Maxmuller says:

"*But it is in connection with the moon, and therefore with an allusion to an equally divided lunar zodiac, that the Nakṣatras are mentioned in the Veda. The moon is called the month maker, masakṛt, and one of the principal sacrifices is that by the Full and New moon. The exact time of these lunar festivals is fixed with such minute accuracy, that the*

Hindus, at the time when these public sacrifices were established, or at least when they were regulated by the sacred institutions of the Brāhmaṇas, must have been considerably advanced in astronomy; and the base of their astronomy was the zodiac of the lunar nakṣatras. The gradual growth of astronomical knowledge in India is intimately connected with the whole intellectual and religious history of that country. The primitive division of the year into lunar months must have taken place previously to the first separation of the Aryan family, for the name for the moon and month is the same in the dialects of nearly all its members. The proper names of the months, however, are particularly Indian. Now these Indian names of the months were derived from the names of the Nakṣatras and the names of Nakṣatras were derived in several instances from the names of ancient Vedic deities".

Further in the context of Ṛk X.55.3, which spoke of *four-and-thirty lights* Ludvig has remarked: *'It cannot be doubted that the original Gods were the constellations'*.

In fact not only Soma, but others like Mitra, Varuṇa, Indra etc., having the common epithet Āditya also can be understood as of celestial in nature. As for example note the caricature of Varuṇa reflected in the hymns like:

Ṛk I.24.8: "King Varuṇa hath made a spacious pathway, a pathway for the Sun wherein to travel...".
Rk I.24.10: "Whither by day depart the constellations that shine at night, set high in heaven above us? Varuna's holy laws remain unweakened, and through the night the Moon moves on in splendour.
Ṛk I.25.8: "True to his holy law, he knows the twelve moons with their progeny: He knows the moon of later birth".

Umapada Sen has given a more explicit interpretation to the Soma of IXth Maṇḍala:

"The IXth Maṇḍala of Ṛk saṃhitā describes the Moon and has nothing to do with imaginary Soma juice which was symbolically prepared. In the sky the Soma by turn approached the Ādityas (same as nakṣatras according to Sen) one by one every night, i.e., the gods were delighted to have Soma and for this reason it was symbolically prepared and offered to the gods who were supposed to be present at the altar".

Sen has also pointed out the specific meaning the term 'nakṣatra' had in Vedic times:

"The very sense which the term nakṣatra or āditya implies readily allows anyone the privilege to acclaim that the word stood only for lunar mansions and lunar mansions alone and refused to shelter under its fold any single star or other constellations shorn of connection with the moon. It is remarkable that the Ursa Major, so famous to the Ṛgvedic Indians due to its proximity to the then pole of the earth was never termed a 'nakṣatra' and it was invariably referred to as the Saptarṣis. Nor did the other constellation, the Prajāpati (elsewhere Kālapuruṣa, Orion) in its long chequered career receive the name nakṣatra, though within its territory and just to its west, the two star groups, the Mṛgaśiras and the Rohiṇī were famous as nakṣatras from times immemorial.

These sidereal divisions for the moon were in use long before the Ṛgvedic period by when these had become pretty familiar and other mysteries of the celestial phenomena were engaging the attention of the Ṛgvedic poets. The conception of Trinava Cakra (Taittirīya saṃhitā VII.1.2.2) or

zodiac with twenty-seven lunar mansions, the nakṣatras, is definitely more ancient than the Brāhmaṇa or the Ṛgvedic period, being stations of king Soma to whom the entire IXth maṇḍala has been dedicated in the Ṛgveda. This Veda had no necessity, no reason, no purpose whatsoever, to serially enumerate the 27 nakṣatras then regarded as the gods, as it was only a collection of poems and not strictly a text for rituals, which were carried out and formulated as per mandatory proclamations based on crude poetical cum prose pieces known as the Nivids. These ritualistic texts, these ancient liturgies did carry the necessary particulars, fragmentary preservation of which, with a few additions and alterations, can still be detected in the Brāhmaṇas"**.

5. Vedic Astronomy versus Chronology

The summary and analysis attempted above leaves no doubt that the Vedic tradition had its beginning at an antiquity beyond 4000 BC. To those who would like to remain stick to the established notion that the Vedas had their origin after 1500 BC some of the interpretations given above may appear far-fetched. Interpretation of the Vedic hymns needs to be made in the light of the phenomena that inspired such outpourings as we see in the hymns. Ancient religions all over the world had its basis in anthropomorphized celestial phenomena and the Vedic religion can be no different. This is evident from the association that we see of the deities with nakṣatras in the Vedas. The following words of

Franz Boll is enlightening in this regard:[5]

"*The history of the belief in stars in a higher sense is a unitary, homogeneous structure. In no other religion such unitariness of ideas over the widest spheres of the earth is established. Above all it became the common possession of all religions of the Mediterranean region and of Near East and reached also, in its radiating influence, far towards Eastern Asia. Christianity, the East and the West – all are connected in this belief in a great continuity of spiritual life, in spite of Spengler's contrary assertions. No fact of spiritual life can demonstrate such continuity better than the history of belief in the stars... In the worship of the stars there is a direct connection between religion and science. Already the Babylonian priests appear to have represented both; since their days, side by side, with the belief in the stars, there goes on the attempt to at scientific mastery of the knowledge of the celestial bodies*".

What Boll has spoken of the Babylonian priests is equally true about the Vedic Ṛṣis. The deities eulogized in the hymns cannot exclusively be the products of imagination. They were visible to the Ṛṣis and as for the theatre in which such drama would have unfolded there is no choice other than the celestial sphere. Imagination would have come into play only in the description of the astronomical phenomena.

** Sen has quoted Ṛk I.89.3, I.96.2, II.36.6, IV.18.7, VIII.13.14 and VI.67.10 with the accompanying discussion:" It appears that the Ṛgveda is not the eldest text in the Indo-Aryan world but ritualistic texts known as Nivids were prevalent before the flowering of Ṛgvedic poetry over flooded the land and the priests mainly relied on the authority of those texts to carry out their sacrificial rituals. The Ṛgveda itself testifies to it and this stands conclusively proved as an axiomatic truth...The Brāhmaṇas, or the later ritualistic texts, therefore, do include some elements whose employments in Yajnas stood sanctioned by Ṛṣis and which were in fact more ancient than the Ṛgveda itself. So whatever we find in the Brāhmaṇas, specially the formalities on which ritualistic fundamentals were based, need not on all accounts be set aside as post dated to the Ṛgveda..."

[5] Quoted by Hinze, O.M., in Tantra Vidya at p.40

As can be understood from the Nirukta, the terminology of the Vedas had become cryptic even in the days of Yāska and as such the real identity of the Vedic deities may remain a mystery. But still as shown by Sengupta in the identification of 'Maghavan' as the summer solstice heralded by the heliacal rising of Maghā or Regulus and "Aśvins' as the α and β - Arietis which heralded the advent of spring by their heliacal rise, astronomical interpretation can be thought of not only for the Vedic hymns but also for the Epic and Purāṇic episodes that apparently have got an astronomical flavour. An attempt will be made in this direction in one of the succeeding chapters.



IX

ASTRONOMICAL BASIS OF HINDU RELIGION

"No system, no theory, no formula, connecting those phenomena could possibly have sprung suddenly into existence at the call, or upon the dictation of a single genius. Far rather it is to be supposed that little by little, and after many arduous labours of numerous minds, and many consequent periods passed in the investigation of isolated phenomena, a system could be expected to be formed into a general science concerning them".

W. Brennand

"If living on fruits and nuts is of superior merit then monkeys and kine would go to heaven before humans: if bathing in holy streams would ensure heaven, then the fishes in the Ganges and Jumna would obtain paradise before men"

"...whatever individual scientists may say, it is not true that science has cut away the roots of revealed religion. That is beyond its power, though its legitimate critiques have starved the roots of material nourishment and thus weakened or destroyed the faith of the merely credulous. I cannot accept that it is a fault in scientists that they have worked hard to eliminate demonstrable errors, although it is perhaps a fair charge that they have frequently tackled the job with uncharitable gusto. There are those who have gone further and assumed authority in the name of science, to brand all belief as superstition. They have abandoned healthy skepticism in favor of bigotry...'Science made us, science broke us', – it has taken away our ancient faith and given us nothing in return... One cannot arbitrarily choose to build a religion out of an idea; it must spring from a deeper source – the thirst for understanding not just how, but why? If one has been persuaded that science, the only purveyor of truth, can at best tell one how and with the aid of philosophy has denied the validity of 'why' questions, one will find no satisfaction in a contrived surrogate"

IX

ASTRONOMICAL BASIS OF HINDU RELIGION

The scientific spirit that was in born in Hindu society of yesteryears is evidenced by the astronomical origin of its various customs and traditions. We saw in the preceding section glimpses of the Vedic heritage – greatest of the intellectual heritage that the humanity has received from the so-called prehistory. The ancient people believed that the divinities have their abodes in heaven 'Devagṛhā vai nakṣatrāṇi' and so they keenly looked upon them and communicated with them and finally learned to interpret their movements in terms of seasonal rhythms that had a bearing up on their lives. Slowly, in this process those Gods came to exercise control over the social life below through the priesthood that evolved as interpreters of the will of gods, the early originators of astronomical calendars. Anthropomorphic narrations of celestial phenomena over the years led to the genesis of different gods and ultimately when the astronomical rationale was forgotten a galaxy of such gods persisted to stay in our minds that have forgotten their scientific habits. Even though we live today in a world that is described as modern, the scientific habit of mind that characterized our civilization has become extinct and we live on superfluous a tradition that has ceased to care for the rationale of their actions. This section is a brief look into the problem of degeneration of the Hindu customs and traditions as the society has chosen to keep itself away from scientific thinking and the canopy of the gods that tuned social life in ancient times with the natural rhythms.

1. Calendar based religion

Brennand[1] wrote more than a hundred years ago:

"The early religion, indeed, of the Hindus, like other religions, had, as we know, a close intimacy with time and seasons; and there was in connection with their rites and ceremonies, a calendar to set forth the order in which they should be observed. This calendar in the early period referred to, had naturally an imperfect character, which led to methods afterwards adopted for its improvement, generally with a view to its adaption to religious rather than secular uses.... With the Hindus, this study became a sacred duty, at least amongst the more educated classes, in as much as the celestial bodies were viewed as Gods, and the worship of them was enjoined by the Vedas. Thus the piety of the Hindus in primitive ages led them to watch with care all the phenomena of the heavens, and to perfect the calendar of their festivals, etc., and to this end the first Hindu astronomers must have directed their particular attention.... Amongst the injunctions enforced the Institutes of Manu is contained a remarkable one making it imperative that

[1] Brennand, W., Hindu Astronomy, pp.25 –27 (1896)

the professions and trades pursued by the people should be followed only by those distinctively taught in them. Under the rule thus enjoined, each trade or calling came to be followed by distinct families, the secrets and artifices of such trade or calling being preserved in exclusive classes and sects of the population. The knowledge acquired by the Hindu astronomers was similarly guarded, with the greatest care, as sacred, and was supposed to be so secret that it was not known even to the Gods. It was not to be communicated to the common people, and, *being regarded as a revelation to inspired saints, was only to be divulged to disciples similarly inspired*. This secretiveness has probably contributed, in some degree, to the difficulty now experienced in tracing the early history of the science of astronomy amongst the Hindus".

Further we can find:[2]

"...it has been the author's desire, by the preceding explanations, *to dispel some of the supercilious ridicule cast by some western critics upon Hindu methods of dealing with astronomical time, and upon their mythology*. Such ridicule would appear to be unmerited, since the subject of it has been misunderstood. So far from the extraordinary numbers of years employed in computation by Hindu astronomers being absurd, it has been shown that they were absolutely necessary to their peculiar system and methods, for ensuring accuracy. *The astronomical mythology, likewise, of the Hindus, grotesque and barbarous as some of their stories may appear, had within it much that was valuable in point of instruction*".

In the words of Sir William Jones:

"We find the whole, like the grotesque picture blazened high and glaring with colors, and fitted with group of fantastic imaginary. *But in the allegorical representation of facts there was always a covert meaning, though it may have escaped the discernment of subsequent writers*".

Vedic religion was Yajña oriented as can be gleaned from the hymns of the Ṛgveda and other Vedic literature. Almost exclusively Gods were representations of natural phenomena sun, moon, day, night, seasons, year etc. Imports of most of the hymns are poorly understood and the terminology is cryptic that the real identity of the deity worshipped often remains a mystery. The best example is 'Agni' itself, invariably identified as 'fire' (of the hearth and heaven) and worshipped as such in many hymns. But these numerous representations that we see for Agni in the different forms of fire present in nature has served to mask the real identity of the 'fire-god' appearing in later mythology as one of the eight dikpālas and an accomplice of Indra who plays crucial role in many Purāṇic episodes. Mahābhārata Āraṇyaparva (219:1-4) credits him with the ancestry of Bṛhaspati, Aṅgiras and Brahma while Śatapathabrāhmaṇa declare him to be the year beginning vis-à-vis time.

The first of the hymns of the Ṛgveda –

Agniḥ Devatā
Madhucchandass Ṛṣiḥ
Gāyatrī chandas

Ōṃ Agnimīḷe purōhitaṃ I Yajñasyādevamṛtvijaṃ I Hotāraṃ ratnadhātamamṃ II

[2] Ibid.p.323

- it self has acquired different interpretations with different scholars as real meaning is lost into oblivion. Extant Niruktas may be depicting a meaning far removed from the original ones and the interpretation as such is left to the ingenuity and bias of the individual minds. The fact that the hymns have become cryptic in the distant antiquity of Yāska itself is attested by the Nirukta, which gives very unnatural or unanticipated meanings for even what we may consider as very ordinary words. A striking example is that of the sun, earth and the bowstring that are called as 'gauḥ' in the Vedas and rays as 'gāvaḥ', which are words to which none may normally credit the representation of sun. Similarly, 'Vṛkaḥ' means a dog/wolf and also sun and moon according to Nirukta and therefore it is essential that the meanings are to be applied wisely to have the true import of the hymns: For example: Ṛgveda I.117.16 & 17 have used the word Vṛkaḥ / Vṛkiḥ in the sense of a dog but at I.105.18, see what mischief the words play:

To quote RTH Griffith: "A ruddy wolf beheld me once, as I was faring on my path. He like a carpenter whose back is aching crouched and slunk away...."

In contrast we can find in the Nirukta:

"The red (bright) moon, maker of the month, indeed, saw (the stars) going along the route. Having observed she rises up like a carpenter with a bent back: be witness of this, O heaven and earth".

Import of the first hymn too might have shared a fate similar to the above in the interpretations such as:

- " I praise Agni, placed foremost, the god, the priest,
  Of the sacrifice; the sacrificer and the best bestower of gifts". [Yāska]

- "I laud Agni, the chosen Priest, God, minister of sacrifice, the hotar, lavishest of wealth". [RTHG]

- "I adore the flame, the Vicar, the divine Ṛtvik of the sacrifice, the summoner who most founds the ecstasy". [Aurobindo Ghosh]

- "I magnify Agni, the Purohita, the divine ministrant of the sacrifice, the Hotr priest, the greatest bestower of treasures". [Oldenburg]

None of this match with the profile that we see of Agni in the Nirukta:

→ Nirukta: 7.5: 'There are three deities only', say the etymologists: (1) Agni, whose sphere is earth; (2) Vāyu or Indra, whose sphere is atmosphere; (3) the Sun, whose sphere is heaven. Of these, each receive many appellations on account of his supereminence, or the diversity of his function, just as a priest, although he is one, is called the sacrificer (hotr), the director of the sacrifice (ashvaryu), the possessor of the sacred lore (brahmā), and the chanter (udgātṛ). ...

→ Nirukta: 5.3:Ṛk X.88.4: "He, the winged one, Agni, who has all created beings as his

property made quickly whatever moves, the immoveable and the movable".

→ Nirukta: 7.9.8: "It has been said before that there are three deities only. Now we shall explain their shares and companions. Now the following are the shares of Agni: this world, the morning libation, spring, the Gāyatrī metre, the triple hymn, the rathantaraṃ chant, and the group of gods who are enumerated in the first place.

→ Nirukta: 7.9.10: Now the following are the shares of Indra: The atmosphere, the midday libation, the summer,the triṣṭubh metre, the fifteen-fold hymn, the great chant and the gods who are enumerated in the middle place as well as women. Now his function is to release the waters and to slay Vṛtra.

→ Nirukta: 7.9.11: Now the following are the shares of Āditya: that world (i.e., heaven), the third libation, the rainy season, the jagatī metre, the seventeen fold hymn, the Vairūpa chant, and the gods enumerated in the highest place as well as women.... One should frame the remaining portions of seasons, metres, hymns, etc. in accordance with the distribution of the places (already mentioned). Autumn, the anuṣṭubh metre, the twenty fold hymn, the Vairāja chant are terrestrial. Winter, the paṅkti metre,the twenty-sevenfold hymn, the śākvara chant are atmospheric. The dewy season, the aticchandas metres, the thirty-three-fold hymn, the Raivata chant are celestial.

→ Nirukta: 8.21: "As soon as he was born, he measured the sacrifice, Agni became the leader of the Gods..."

It is evident from the above descriptions that Agni was the prime deity of Vedic pantheon homologous with Indra and Āditya – all arising out of the earth-atmosphere-sky composite world of seasonal phenomena. It won't be a case of too far fetched imagination to see in the above description the prototypes of Agni → Equator, Indra → Pole and Āditya → Ecliptic, the three authors of seasons. Agni represented the equinoxes (spring and autumn), Indra (summer and winter) represented the solstices and Sun (rainy and dewy) the rhythm of the day, night and seasons. The account that we see of Agni in the Vāyupurāṇa as discussed in Section 6 of the present work in fact allows no other identification of the role of Agni encrypted in the hymns:

Vāyu Purāṇa, chapter 31:

> Ṛturagnistuyaḥ proktaḥ sa tu saṃvatsaro mataḥ I
> Ādityeyastvasau sāraḥ kālāgniḥ parivatsaraḥ II 29 II

Agni is ṛ - tu; for it constantly moves (√ṛ = 'go'); it is saṃ-vat-sara; for it encompasses (√vas = 'clothe') creation and also the time divided into months. It is the essence of Āditya; it is Kāla; for it counts while it burns (√kal = 'count'); it is pari-vat-sara 'the all-round encompasser'.

The point to be signalized here is the identification of Agni with Kāla, for which cp. Vāyu Purāṇa:

Brahmāviṣṇuścayajńśca kālasyaiva kalāstrayaḥ I
Sarveṣvevahi kāleṣu caturmūrtir maheśvaraḥ II 33-22 II

Ahaṃjanojanayitā vaḥ kālaḥ kālapravartakaḥ I
Yugakartā tathā caiva paraṃ paraparāyaṇaḥ II 33 –23 II

Eṣakālaścaturmūrtiścaturdaṃṣṭraścaturmukhaḥ I
Lokasaṃrakṣaṇārthāya atikrāmati sarvaśaḥ II 33 –28 II

Nāsādhyaṃ vidyate cāsya sarvasmin sacarācare I
Kālaḥ sṛjati bhūtāni punaḥ saṃharatikramāt II 33 – 29 II

Sarve kālasya vaśagā na kālaḥ kasyacid vaśe I
Tasmāt tu sarvabhūtāni kālaḥ kalayate sadā II 33 – 30 II

Agni is Kāla; it is born at the beginning; the moment it starts functioning (√aj = 'drive' or √ańj = 'anoint') it becomes Kāla (√ kal = 'count'), i.e., it develops into that, which counts while it creates; the two functions of Agni being indivisible.

This significance of Kāla is typified in the Vāyu Purāṇa in chapter 30:10-22:

Kālāvasthāstu ṣaṭ teṣāṃ māsākhyā vai vyavasthitāḥ I
Ta ime ṛtavaḥ proktāscetanācetanās tu vai II 10 II

Prajāpatiḥsmṛtōyastu sa tu saṃvatsaro mataḥ I
Saṃvatsarasmṛtohyagniḥ ṛtaṃ ityucyate dvijaiḥ II 21 II

Ṛtāt tu ṛtavoyasmājjajńire ṛtavas tataḥ I
Māsāḥ ṣaḍ ṛtavojńeyās teṣāṃ pańcartavaḥ sutāḥ II 22 II

Agniṣvāttā barhiṣadaḥ pitaro dvividhāḥ smṛtāḥ I
Jajńāte ca pitṛbhyastu dve kanye lokaviśrute II 27 II

Menā ca dhāriṇī caiva yābhyāṃ viśvamidam dhṛtaṃ I

The purport is: Agni, evolved as Kāla, is ṛ - tus; these constitute saṃvatsara, the origin of creation in its various forms: the Pitṛs, the sons of the ṛ - tus, give birth to two daughters: Dhāriṇī and Menā, who create this world.

It is, thus, Agni, identical with Kāla, which works through the six seasons..."

I have reproduced the whole page in view of the extreme importance of the true identification of Agni in understanding the Vedas. It is not by accident that the verse -

Ōṃ Agnimīḷe purōhitaṃ I Yajńasyādevamṛtvijaṃ I Hotāraṃ ratnadhātamamaṃ II

- had its appearance at the outset of the greatest compilation of the holy scriptures; It is the flame that casts light on the rest of the Ṛks and in the light of the above discussion the hymn may be translated as:

"Ōṃ, I praise Agni, born of the ṛtus and is at the helm of the year like a priest who bestows gifts to all in a sacrifice".

As scholars may challenge this interpretation I am to submit the following explanation: Identification of Agni is contained in the middle part – Yajṅasyadevamṛtvijaṃ - which I have rendered as 'born of the ṛtus (ṛtvijaṃ) and is at the helm (deva→deity→one who presides) of the year (Yajṅa)' and the rest follows automatically.

Yajṅa → Year

The elaboration needed to establish this synonymy is available in 'Orion' by Tilak who has chosen the title "Sacrifice alias the Year" for the second chapter and further he has spoken:

"There are many passages in the Brāhmaṇas and Saṃhitās, where Saṃvatsara and Yajṅa are declared to be convertible terms and no other theory has yet been suggested on which this may be accounted for, I am therefore, inclined to believe that the Vedic Ṛṣis kept up their calendar by performing the corresponding round of sacrifices on the sacred fire that constantly burnt ..."

Appellation 'deva' receive further support from the conception of Devayana as from spring to autumnal equinox, the two Agnis that sandwich the path of the gods.

This identification of Yajṅa and Agni as the seasonal year and its subtle beginning meet with a lot of ramifications in the comprehension of Vedic religion. In our discussions on Vedic astronomy we have already seen that the hymns themselves formed a part of the intellectual efforts to achieve a perfect solar calendar by means of appropriate intercalations. In the work of Daftari we saw that hymns were created at the end of Yugas/ Manvantaras/ Kalpas of 4-Years and the metre Rathantarṃ signified the end of a period of 28 Kalpas. Perhaps a count of the days or years is incorporated in the metrics/syllable structure of the hymns or we may go a step further and infer that the chandas was created for the purpose of reigning time. Roy has given an interpretation slightly different from the common genre to the verse Ṛgveda I.164.39 as:

"The ṛks are written in the high heavens: What shall he do with the earthly ṛks, he who cannot read those heavenly ones?"

Further as the present author understands it was Roy who first identified the eight Vasus, eleven Rudras etc. with the number of solar years that formed a seasonal cycle in harmony. Sidharth has gone further and has found a more detailed meaning for the accreditation he finds of Gāyatrī with the Vasus and Trṣṭūb with the Rudras in the rescensions of the Yajurveda: The three pādas of Gāyatrī accordingly signify the three intercalary months occurring in the course of 8 Vasus or lunar years and the four padas of Trṣṭūb likewise represent the four-month's intercalation over 11 Rudra years – both together of course shall form a perfect cycle of seasons in 19 years.

Ṛk I.164.23 and 24 are very important in this context:

• How on the Gāyatrī the Gāyatrī was based? How on the Triṣṭup they fashioned the Triṣṭup forth? How on the Jagatī was based Jagatī? – they who know this have won themselves immortal life.

• With Gāyatrī he measures out the praise-song, Sāma with praise-song, triplet with the Triṣṭup. The triplet with the two or four-foot measure, and with the syllable they form seven metres.

[RTH Griffith]

These ṛks in fact represent an inquiry into the rationales of different metres such as Gāyatrī and it is apparent that the secrets enshrined in their construction were not a matter of common knowledge. The whole of the hymn I.164 is on the astronomical phenomena and the 25th verse is especially noteworthy:

• "With Jagatī the flood in heaven he established, and so the Sun in the Rathantara Sāman. Gāyatrī has they say three bands for kindling; hence it excels in majesty and vigor.

This verse depicts the purpose served by the metres Jagatī, Gāyatrī and the verse Rathantara Sāman, in a cryptic terminology. We know from the work of Daftari discussed earlier the relation between the Sun and Rathantara – the latter representing the great Maṇḍala of sun of 28 Kalpas = 112 years = 40907 –28 = 40879 days. Jagatī and Gāyatrī too had such representations involving the maṇḍala or revolutions of sun, which remains to be deciphered from the ancient literature with appropriate interpretations as we have attempted earlier. Śyāmaśāstri's discussion on the Gavāmayana vis-à-vis Nidāna sūtras also point towards a significant role for various chants in the sacrifices where the extent and oblations[1] symbolically represented the Year or Prajāpati whom the sacrificers sought. To quote one of the important conclusions of Śyāmaśāstri:

"*It follows therefore that there were four schools of astronomers during the Vedic times:*
→ A school who observed 11 days at the end of each synodic lunar year
→ A second school who celebrated five days at the end of each Sāvana year
→ A third school who observed 21 days ofcourse at the end of four consecutive sāvana years
→ And a fourth school who celebrated 12 days at the end of every fourth synodic lunar year.

It is clear therefore that the statement made at the close of the Taittirīya Brāhmaṇa, that 250 times 21 days denoted 1000 years for the Viśvaṛiks, is not a theoretical formula, but a result arrived at by regular counting made by successive generation of priests..."

When examined against this backdrop of the Vedic pursuit of a life in harmony with

[1] "Ekaikayā vā āhutyā dvādaśaṃ dvādaśarātrīrayukta. Tā yāvatīssaṅkhyāne tāvatīsaṃvatsarasya rātṛayaḥ..." Maitrāyaṇsaṃhitā 1.10.8.

nature and its seasonal rhythms the novel interpretation attempted above of the first verse presents no contradiction. Based on Yāska's Nirukta alone it is easy to understand that the terminology we see in the Vedas had become cryptic since very early times and as such the study of Vedas call for creative and intelligent work if we intend to understand the true spirit of Vedic religion.

Symbolism Inherent in Agni

Agni as 'fire' obviously had a vital role in the lives of ancient people and must have been the source of many primitive conceptions all across the globe. But that was not the case with the Vedic civilization where the conceptions were really very advanced like the language they spoke and expressed in a symbolism that is unfamiliar to the modern man. Agni, for example symbolically represented the seed of the year in view of the similarity of the processes that produced both viz., the fire and the seasonal year. In the production of fire the cavity 'Drōṇa' and the pole 'Araṇi' played the same role as that of the earth and its axis (celestial pole) in the production of seasonal year. In later purāṇic/epic literature, this fundamental "Droṇa – Araṇi → Agni " relationship metamorphosed into mythology when combined with the zodiacal symbolism of the signs Vṛścika and Dhanu ruled respectively by Bharadvāja and Brhaspati i.e., Mars and Jupiter. The fall of autumnal equinox and year beginning over Mūla placed Agni at the junction of the above signs and credited Agni with the ancestry of Bṛhaspati and Aṅgiras (synonym of Mars). Further, in the Tāntric tradition Mūla marked the genitals and symbolically marked the seat of Yogāgni. As the equivalence of Drōṇa or Yajña-kuṇḍa, here we see the seat of Agni as 'Kuṇda' and the fire born of yoga received the name Kuṇḍalini. In the epic mythology Bharadvāja (who stands for Mars the lord of Vṛścikā) placed his seed in a dṛōṇa and from the same an Archer was born named Dṛōṇa who in turn begot a son called Aśvatthāmā. In this name too we can find a connection with Agni as 'araṇi' is the stick of Aśvattha.

It is apparent from the above discussion that the Tāntrics considered the beginning of the year – as the seed arising out of the maithunam (Kumāra in mythology) in view of Mūla's representation of the genitals while the Vedic cults abstracted Mūla's representation of the genitals into Dṛōṇa and Araṇi and described the year beginning in terms of the seed Agni.

• Epic mythology is substantiates this interpretation by describing:

→ Dṛōṇa's death in Yogic posture at the hands of Dhṛṣṭadyumna, who had his birth in Yāgāgni or the ritual-fire. Dhṛṣṭadyumna represented the autumnal equinox (Agni of rituals or Yāgāgni) that receded from Mūla or Sagittarius (Dhanu) while Dṛōṇa the Archer represented the sidereal Dhanu rāśi who also represented Yogāgni – and was fighting on the side of Gaṅgāputra Bhīṣma, the invincible fiducial star Mūla.

→ Pāñcāli, born of Yāgāgni along with Dhṛṣṭadyumna, having the appellation of Kṛṣṇa, sharing the profile of five-year Yugas – in view of the synonymy of Pāṇḍavas with the five years saṃvatsara, parivatsara etc

→ Kṛṣṇa, representing summer solstice coinciding with Bhādrapada kṛṣṇāṣṭami and

wielding the Cakra, as charioteer of Arjuna representing the Sun

→ Drauṇi profiled as a fierce warrior like Bhīṣma himself and synonym of death is another represenation of Dhanu holding Vega or Abhiji (Maṇi), partaking the destructive aspect of time/ Mūla (Nirṛti or Kāla) who sets fire to the Pāṇḍava camp.

→ Also we can find in the birth of Kumāra Kārttikeyā, the role of Agni, Svāhāḥ and Gaṅgā in handling the seed of Rudra, which is illustrative of the identity of Agni coincident with Mūla.

→ Araṇi Mathanaṃ and Amṛta mathanaṃ are analogus events conceived in mythology. All 'devas' are considered as Agni as Agni marks the beginning of Devayānaṃ.

→ Rāmāyaṇa too is based on the astronomical epoch of 4137 BC when Nirṛtya Rāvaṇa (personification of Mūla) took possession of the city on the equator, Lanka (autumnal equinox).

Reflected in the above symbolism of Agni are the efforts by an ancient civilization to regulate their life in tune with the nature with the help of astronomical knowledge derived from observations running over perhaps thousands of years. Many of the Hindu celebrations can therefore be traced to the astronomical phenomena such as year beginnings, cardinal points (equinoxes and solstices) moon's phases such as new moon full moon and the quarters or the luni-solar phenomena etc. We shall revert to this aspect further in the discussion on Uttarāyana and Dakṣiṇāyana, after a brief look at few other features of the Hindu way of life.

• A number of other gods too appear in the hymns like Vivasvān, Savitṛ, Puṣān, Viṣṇu and the twelve Ādityas, Indra, Varuṇa, and Mitra etc. but these different names probably are the different forms sun assumes during His annual course across the sky.

Indraṃ mitraṃ varuṇamagnimāhu rathōdivyaḥsasuparṇō Garutmān
Ekaṃ sadviprāḥ bahudhā vadantyagniṃ yamaṃ mātariśvānamāhuḥ

Ṛgveda I.164.46: "They call Agni, Indra, Mitra and Varuṇa; they also say that he is the divine Garutmān of beautiful wings. The sages speak of him who is one in various ways; they call him Agni, Yama, Mātariśvan".

• Historians of science have invariably shown a strange attitude towards interpreting the prevalence of astronomical observations in Vedic India. To cite such a typical account:

"The Vedas prescribed various yajñas or sacrifices to be performed in different seasons of the year. The duration of these sacrifices used to vary; some were seasonal, some four-monthly, some yearlong, and others even longer. It was necessary to calculate the time to begin and end a sacrifice. This presumably led the Vedic Indian to turn to astronomy".

Here we have a wrong comprehension of the Vedic astronomical origins that leaves a

very important question unanswered viz., what inspired them to prescribe season linked sacrifices? How did they come to attach significance to specific moments and durations to begin and complete the sacrifices?

When we contrast the origins of Yajñas with that of astronomy, the latter must be certainly anterior and the former could have emerged only as a result of the comprehension of the natural rhythms not only by experience of seasons but also by an intellectual comprehension of the phenomenon based on astronomical knowledge. Vedic astronomy had its origin in the efforts of the people to maintain harmony with the nature's rhythms and it was for this purpose that the calendar consisting of luni-solar phenomena was conceived and to gain a grip with the eternal flow of cycles Yajñas were prescribed to incorporate time as an essential component of social life as has been deciphered by Śyāmaśāstry from the study of Nidāna sūtras.

In contrast to the Vedic pantheon we saw above, and the ritualistic religion, the present day Hindu way of life is dominated by Āgamic customs of worship related to mythological heroes such as Śiva, Viṣṇu, Durga etc., and their innumerable so-called incarnations. These practices differ from region to region and people follow the degenerated tradition without caring for the rationale and have thus created pseudo Āgamic way of life very often looked upon as the Hindu religion. Further, the mix up of the Vedic and Tāntric calendars have added to the confusion and confusion abounds in the matter of all religious observances that have an astronomical origin. Seasonal or the tropical (Sāyana) and the Tāntric or sidereal (fixed) zodiac, Ācāryās of yesteryears have failed to differentiate their significance and role and therefore the Hindu society has come to lead a humbug religion for the last two millenniums.

• Sāyana versus Nirayana Conflict

In recent years A. Krishen Kaul has rekindled again a conflict that have been plaguing our community since the time of Mahābhārata war at least viz., the adoption of the zodiac for religious purposes – whether it be Sāyana or Nirayana? Since 1997, Kaul has challenged the wisdom of all those who profess a nirayana or sidereal zodiac with 'irrefutable' quotations from the Vedic and Purāṇic literature as well as Sūryasiddhānta to prove that the astrological zodiac had to be Sāyana or tropical. Vehment criticism of Śrī B.V.Raman and Śrī P.S.Sāstry for their adherence to an absolutely non-Vedic zodiac was subsequently made by Kaul but no voice could be heard in defense of these Titans or their pet zodiac of the Indian School of Astrological Journalism. Kaul's attempt to enlighten the fossilized minds of the nirayana astrologers did not meet with much success as is evident from the lukewarm response it evoked from the Rāman and the Citrapakṣa lobbies. One of the responses that Kaul has quoted is typify the attitude common among people who are affiliated to astrology and had the aptitude to understand the scholarly discourses of Kaul: To quote:*

"I fully agree with you that all our Śāstras and Siddhāntas including the Sūryasiddhānta have been advocating and following a tropical zodiac, a sāyana Rāśicakra. Now if inspite of knowing it to be so I am myself publishing a nirayana Pañcāṅga, it is only because in

* 1998 Ephemeris; p.2

this land which is (presently) full of duplicity and being led by ambivalent leaders, I have to fall in line with the majority...'.

Further, Kaul has quoted a few remarkable pieces of wisdom from the Gītā, which I hope he himself shall assimilate and apply to his own life in the aftermath of the publication of the present work that attempts to correct his perceptions in the same way as he had attempted to correct the nirayana astrologers.

Gītā 3:7:38: Nā/satōvidytebhāvō nā/bhāvōvidyate sataḥ I
Yattu nāsti svabhāvena kaḥ kḷeśastasyamārjane II

The thing that is non-existent cannot be made to exist and what exists cannot be made non-existent. What difficulty can be there in removing something that has no existence by its very nature?

Yuktiyuktamupādeyaṃ bālānāmapiśukādapi I
Anyatṛṇamivatyājjyaṃ apyuktaṃ padmajanmanā II

What is talked rationally must be accepted even if it is from a child or parrot and no cognizance be given to irrational and illogical matters even if it has arisen from the One born of lotus.

• **Deficiency of Kaul's Thesis**

What made Kaul to drift from Citrapakṣa to the Sāyana Rāśicakra is the lack of any physical rationale behind the Citrapakṣa Rāśicakra and the allusions that we see in the Vedic and Purāṇic literature of a Zodiac pivoted on the cardinal points. As we have seen already no scientific mind can accept the irrational proposition of an arbitrary choice of the initial point such as the point opposite Citra or that of Revatī to define the rāśi-nakṣatra substratum employed in astrology. Equally disastrous is the sāyana conception of a regressing zero point or a Rāśicakra having rāśis and nakṣatras undergoing perpetual modification of their limits due to the precession of the equinoxes. Notwithstanding certain silly comments made by Kaul on the supposed fixity of the sidereal zodiac, I am to uphold that the sidereal zodiac I have presented – the Mūlādhāra Rāhu-Śikhi Cakra - is eternally fixed and even if it is proven that Mūla is having a proper motion of one second or two second over a millennium, it is of no consequence here in view of the occult and physical principles over which the fiducial star is based (as already outlined in the preceding sections). In contrast to the Tāntric zodiac, the sāyana seasonal or calendar zodiac has no locus standee in astrology in view of the two equinoxes and two solstices, which equally qualify as the zero point.

• Why should a particular equinox be chosen as the zero in preference to others?

• Many Vedic hymns suggests year beginning with either of the solstices or autumnal equinox – like we see in Vedāṅga Jyotiṣa where winter solstice is the zero point – Under such circumstances what makes Kaul to choose the spring equinox as the zero of the Sāyana zodiac?

In fact the Vedas or Brāhmaṇas contain no astrology and the astronomical references are all calendar or seasonal or astronomical phenomena related and the seasonal year could have begun with either of the cardinal points and that is what we see in the Vedic literature. When Kaul wrote his essays he was unaware of the possibility of a sidereal zodiac other than the lopsided conception such as Citra and Rāman zodiac and as such he denied the possibility of two zodiacs – one over which the seasons or calendar is based "Ṛtucakra" and the other "Rāśicakra" of astrological use – on page 26 of his 1997 ephemeris under the title: '*To presume two zodiacs will be most ludicrous and ridiculous*'. On the contrary the present author considers two zodiacs, Ṛtucakra and Rāśicakra as very essential to explain the astronomical basis of Hindu way of life, which is a mix up of the Vedic and Tāntric traditions.

In the course of the present discussion on the astronomy/zodiac underlying Hindu religion this aspect will be further looked into as and when occasion arises. We shall begin the discussion with the most important of the Hindu celebrations viz., Dakṣiṇayana and Uttarāyana.

Uttarāyana & Dakṣiṇāyana.

'Uttarāyana' being the most important astronomical phase of the Hindu way of life, the following words of Bāl Gaṅgādhara Tilak will be an ideal beginning for a discussion:

"... *We must therefore take great care not to allow the idea of Uttarāyana, as we now understand it, to obscure our vision in interpreting the early Vedic traditions, and that too much care can never be taken is evident from the fact that even so acute an astronomer, as Bhāskarācārya was at a loss to correctly understand the tradition that the Uttarāyana was the day of the Devas. In his 'Siddhāntaśiromaṇi' he raised the question how the Uttarāyana as it was generally understood in his day could be the day of the Devas?*

...If the sun is visible to the Gods at Meru (North Pole) from the vernal equinox to the summer solstice, its passage back to the autumnal equinox lies through the same latitudes and in that passage, i.e. during the three months after the summer solstice the Sun must, says Bhāskarācārya, be visible to the Gods. But according to the Samhitā-writers the day of the Devas ended with the Uttarāyana, that is, as Bhāskara understood the word, at the summer solstice. How is this conflict to be reconciled? Bhāskarācārya could give no satisfactory solution of the difficulty..."

Better words cannot be found to illustrate the confusion prevailing in post-Vedic or Siddhāntic astronomy even at the fundamental conceptual level. Date of Bhāskara II is Śālivāhana Śaka 1105 (Kali 4284) and some of the modern scholars may be inclined to interpret the aforesaid confusion as created by Bhāskara II by his unwarranted excursion into the Samhitās / Purāṇas which describe Uttarāyana as the 'Day of Gods'. But that is not the case. In fact almost seven centuries earlier Varāha Mihira had to confront the same intricacy in his work Pañcasiddhāntikā. We can see in the XIIIth chapter, śḷokas 12 and 13:

Meṣavṛṣamithunasaṃsthe divaso*f*rke karkaṭādige rātṛi I
Yairukto vibudhānaṃ merusthānāṃ namasthebhyaḥ II12 II

Yeṣvevōdaṅ meṣādisthāneṣu saṃnivṛttōpi I
Teṣveva kathaṃ dṛśyaḥ punarnadṛśyaśca tatrasthaḥ II 13 II

(12) Some day, when the Sun is situated in the three signs Meṣa, Ṛṣabha and Mithuna, it is daytime for the Devas, but when in the signs Karkaṭaka, Siṃha and Kanyā, it is nighttime. I salute them, (and wish to be rid of them since they are quite wrong).

Note: The authors of the Dharmaśāstras, followed by the generality of people, consider that the Uttarāyana, i.e. the northward course of the Sun from the beginning of Makara to the end of Mithuna is daytime for Devas. Its southward course from the beginning of Karkaṭaka to the end of Dhanus is considered their nighttime. It is their ignorance that is referred to here.

(13). Moving in the same north latitudes when in Karkaṭa, Siṃha and Kanyā, as when in Mithuna, Ṛṣabha and Meṣa, how can the Sun be seen and not seen by the Devas, so that it is daytime (in the first three months) and nighttime (in the next three months).

Note: The mistake of these people lies in thinking that Uttarāyana is the daytime of the Devas and Dakṣināyana is nighttime. It is only when the Sun is north of the equator while in the 6 signs Mesa to Kanyā, it can be seen by the Devas, forming their daytime and in the 6 other signs it cannot be seen and it is nighttime.

[Translation byT. S. Kuppaṇṇa Śāstry and Dr. K. V. Śarma along with their notes]

In the short notes by the translators also we can see the controversy while explaining Mihira's view.

• **Reconciliation achieved by Tilak**

To reconcile the contradictory viewpoints Tilak had to go back to the Vedic phase of our civilization where in the term Uttarāyana probably had a different connotation. On Garga's view quoted by Bhattotpala, Tilak has provided the following comments:

"...What has been said above is, I believe, may mean "turning towards the north from the southernmost point", or it may indicate "the passage of the Sun into the Northern Hemisphere, i.e., to the north of the equator". If we adopt the first meaning, the Uttarāyana and the year must be held to commence from the winter solstice while if the second interpretation be correct, the Uttarāyana and the year must have once commenced with the vernal equinox. The fact, that the Central day of the annual 'Satra' was called 'Viṣuvan', that Vasanta or spring was considered to be the first of the seasons, and that the 'agrayāneṣṭis' or the half-yearly sacrifices were required to be performed every 'Vasanta' (spring) and 'Śarad' (autumn) clearly show that the second of the two interpretations given above is more likely to be the older one...".

Tilak goes on, to adduce evidence in favor of the Uttarāyana commencing at the vernal equinox and says:

"...It is impossible to maintain that the Devayāna or the Uttarāyana ever commenced with

the winter solstice, for in neither hemisphere the winter solstice marks the beginning of spring, the first of the Deva seasons.... We must therefore hold that Devayāna in those days was understood to extend over six months of the year, which comprised the three seasons of spring, Summer and rains i.e., from the vernal to the autumnal equinox, when the Sun was in the northern hemisphere or to the north of the equator...."

The above rationale of Tilak provides a logically consistent explanation for the concepts Devayāna, Pitṛyāna, etc., available in Vedic literature. These terms originated at a time when our ancestors lived somewhere near to the North Pole where the sun is visible from vernal equinox to autumnal equinox. As regards the change in connotation that occurred in course of time Tilak had the view:

"It is difficult to definitely ascertain the time when the commencement of the year was changed from the vernal equinox to the winter solstice. But the change must have been introduced long before the vernal equinox was in the Kṛttikās and when this change was made Uttarāyana must have gradually come to denote the first half of the new year, i.e. the period from the winter to the summer solstice, especially as the word itself was capable of being understood in the sense of "turning towards the north from the southernmost point".... After a certain period the beginning of the year was changed to the winter solstice and it was some time after this change was made that the words Uttarāyana and Dakṣiṇāyana came to be used to denote the solsticial divisions of the year.... With the year the beginning of the annual satras was also gradually transferred to the winter solstice and the change was complete when the 'Taittirīya Saṃhitā' was compiled. In fact had it not been for the passage in the 'Śatapathabrāhmaṇa' it would have been impossible to produce any direct evidence of the older practice.... The old practice was not however completely forgotten and for the purpose of the Nakṣatra-sacrifices the vernal equinox was still taken as the starting point. Thus it is that Garga tells that "of all the Nakṣatras the Kṛttikās are said to be the first for sacrificial purposes and Śraviṣṭhā for (civil) enumeration". But even this discrimination appears to have been eventually lost sight of by the later writers and all references to Uttarāyana were understood to be made solely to the six months from the winter to the summer solstice, an error from which even Bhāskarācārya did not escape, though he perceived the absurdity caused by it in some cases. At the present day we on the southern side of the Narmada begin the year at the vernal equinox for all Civil purposes, but still all the religious ceremonies prescribed to be performed in the Uttarāyana, are performed during the Uttarāyana beginning with the winter solstice, a position quite the reverse of that described by Garga...."

It is important to note here that more than a century ago Tilak was disgusted with the departure of our religious observances from the real Vedic traditions. Despite his busy role in the freedom struggle, he had tried to put the wheels of research & reforms into motion but orthodoxy and unscientific prejudices prevented the wheels from rolling on. So even after centuries since the time of Mihira & Bhāskara we find ourselves pitted against

the same confusion - perhaps even more in view of the fact that we have nailed the 'Viṣus' & the 'Ayanas' onto the quadrangular points of the sidereal fixed zodiac i.e. to the beginnings of the nirayana solar months Meṣa & Tulā as well as Cancer & Capricorn, respectively. We are short of sufficient wisdom to realize that the 'Viṣus' and the 'Ayanas' have nothing to do with the sidereal fixed zodiac - sidereal method being only a mathematical description required for astrological purposes.

Since time immemorial the zodiac has been sidereal as is evident from the 12 'Rāśis' and 27 'Nakṣatras' having fixed limits and shapes. Equinoxes & solstices traversing the symbolic stellar background inspired the Vedic seers to record them in mythological descriptions. They have no permanent association with the solar ingress into Meṣa, Tulā, Karkaṭaka, and Makara. Confusion prevailing is the result of Siddhāntic texts that assumed zero ayanāṃśa or coincidence of the sidereal and tropical zodiacs at their respective epochs. Our effort must be to understand the true astronomical rationale behind the religious observances like those of:

'Viṣu saṃkramaṃ' refers to solar ingress on to the equator or "viṣuvatvṛttaṃ" that makes the day and night of equal duration and is not related to nirayana Meṣa-saṃkramaṃ. As described earlier 'vasanta-viṣu' marks the beginning of Uttarāyana or sun's sojourn over the 'Devapathaṃ' while 'śarad-viṣu' is the solar entry into the Asura-sector or Dakṣiṇāyanaṃ.

In the quotations[1] given by Kaul, the aforementioned controversy is very much apparent but he has not given any cognizance of it perhaps due to the difficulty of reconciling the contradiction involved. Especially, he has quoted Hari Svāmin at page 99:

"*When the sun turns north it is in the gods (that is it becomes visible to the gods). When it turns south it is in the manes (that is it becomes visible to the manes). (Here the commentary of Harisvāmin says that by north it means when the sun starts going towards Uttara Goḷa and by South it means when it starts going towards Dakṣiṇa Goḷa i.e. Uttarāyana and Dakṣiṇāyana respectively)*".

It is therefore well evident that the Purāṇic and epic quotations bearing upon astronomy reproduced by Kaul have got a fundamental error in the conception of a religiously significant astronomical phenomenon viz., Uttarāyana and Dakṣiṇāyana. This confusion arose out of the mix up of two different conceptions in antiquity – Devayāna and Pitṛyāna

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[1] →On page 86 of the 1999 ephemeris we can find Manusmṛti verse:
Taiḥ (māsaḥ) ṣadḥabhirayanaṃ varṣe dve/yane dakṣiṇōttare I
Ayanaṃ dakṣiṇaṃ rātṛirdevānāmuttaraṃ dinaṃ II

→ Harivaṃśaṃ:Devānāṃ tadahōrātraṃ diva caivōttarāyaṇam I (page.95)
Dakṣiṇāyanaṃ smṛtā rātṛiḥ prājñaistattvārthakovidaiḥ II

of an earlier epoch got mixed up in later times with the declinational movement across the solstices. If we consider the epoch of 4137 BC, the two zodiacal divisions were:

Devayāna	**Pitṛyāna**	**Uttarāyana**	**Dakṣiṇayana**
Mithuna	Dhanu	Mīna	Kanyā
Karkaṭaka	Makara	Meṣa	Tulā
Siṃha	Kuṃbha	Vṛṣabha	Vṛścika
Kanyā	Mīna	Mithuna	Dhanu
Tulā	Meṣa	Kaṭaka	Makara
Vṛścikā	Vṛṣabha	Simha	Kuṃbha

Autumnal equinox over Mūla with Nirṛti (synonym of death as well as earth) as the deity marked the beginning of Pitṛyāna at the point where Ākāśa Gaṅgā cuts the ecliptic and sun crossed into the southern hemisphere to become visible to the Pitṛs. It is possible that another school of thought considered the summer solstice as the year beginning and erroneously conceived the Pitṛyāna as the first half of the year when the duration of the day declines to reach a minimum at the winter solstice. Apart from such sāyana configurations possible in 4137 BC with reference to the equinoxes and solstices there is the likelihood of a permanent division of the ecliptic and the sky into two worlds – Mūla marking the east end of Devaloka and the west end of Pitṛloka and both the worlds covering six rāśis each – and when the legend took shape sun was visible to the Pitṛs for the six months from Mūlasaṃkrama and vice versa. The question as to what constitutes the Pitṛpakṣa or the appropriate time for Śrāddha needs to be examined against the above background to ascertain the original tradition. According to the present author, equinoxes and solstices are astronomical phenomena rather than any specific points suited to serve as a boundary or fixture in the sky. When considered as points they are regressing points in much the same way as Rāhu and Śikhi and they assume significance only when the sun transits over them. They are simply particular positions of sun that marks the quarters of the daylight phenomenon. It is absurd to think of a deity or other attributes to such an ever-regressing point in comparison to the Mūlādhāra Cakra, where the nakṣatras and rāśis have fixed shapes and special attributes that provide them a separate identity. As for example, if we consider the case of Mūla, its deity is Nirṛti – who stand for death, Yama, Kāla etc., and is therefore best suited to be the entry point to the Pitṛloka. Location of Milky Way, which is regarded as the 'path of the manes' reinforces such an identification of permanence rather than a world of ever changing boundaries.

The Deva-Pitṛ and Uttara - Dakṣiṇa sectors of the zodiac are depicted ambiguously in the Vedic and Indian astronomical literature. This confusion can be satisfactorily explained only if we presume great antiquity such as 10600 BC for the Indian civilization consisting of the Tantric and Vedic streams. In 10600 BC, the summer solstice coincided with Mūla and the solsticial line falling over the Milky Way thus gained an association with the 'path of manes'. In 4137 BC, the line of equinoxes received the same identity as they fell over Mūla and the celestial Ganges. Beneath these conflicting identifications, we have the original fixed division of the zodiac into two sectors of Devas and Pitṛs with Mūlabarihiṇi as the boundary. Even in the great antiquity such as 3000 BC, both the line of solstices and equinoxes thus had the association with the Pitṛaloka or world of Pitṛs beginning with

the Dhanu rāśi and these variant identifications in later times played the havoc that we see in Vedic literature. Heliacal rising of Antares marked the advent of rains/summer solstice on Mūla and the end point of Devaloka of which Indra or Antares was the sovereign.

The present day practice may be as per classical injunctions, of conducting the śrāddha in the dark fortnight of Bhādrapada or Aśvina runs contrary to the above picture and the contradiction may be explained as follows: In the aftermath of the Mūlādhāra epoch Pitṛyāna got confused with Dakṣiṇāyana and underwent a 90^0 shift towards western direction to get associated with summer solstice in the tropical calendar and to the Kanyā rāśi in the sidereal zodiac. Thus the dark fortnight of Bhādrapada came to be regarded as sacred for the Pitṛs (Mahālaya pakṣa). But the earlier association of Pitṛs with the autumnal equinox finds its reflection in the secondary Mahālaya pakṣa observed in the dark fortnight of Aśvina, which culminates with Naraka caturdaśi when the Pitṛus are supposedly sent back to their world.

Another possibility is that the classical injunctions over which the rites are performed at present may have their origin or modifications as a result of the mix up of the Tāntric and Vaidic precepts, which favored the autumnal equinox and summer solstice respectively.

This particular observance thus reflects the obliteration of rationale may be due to the 'ayana' or sidereal versus tropical conflict or other historical reasons. If we go by the underlying astronomical rationale the sun is visible to the manes in the South Pole only from the autumnal to the vernal equinox and hence Pitṛpakṣa has to be associated with the dark fortnight accompanying the autumnal equinox. Rationale of 'amāvāsya' or new Moon is that it corresponds to mid-day for the Pitṛs dwelling on the Moon in the region opposite to the line of sight.

2. Durgā Pūja [Navarātri]

The present practice is to observe the nine nights from Āśvina śukḷa (1) whereas the original practice had the beginning on Bhādrapada śukḷa (1) so that on the 8th tithi Moon is in conjunction with Mūla and on the 10th with Śṛāvaṇa[1]. Considering Bhādrapada as the sidereal solar month of Kanyā as in either 4137 BC or AD 1944, the rationale of the festival can be understood. Durgā was the personification of Kanyā as explained in the discussion on Tāntric astronomy and in the epochal year Moon coincided with Mūla for Aṣṭami and with Śṛāvaṇa on Daśami. The account we see in Bhaviṣyapurāṇa is in fact contradictory:

Aśvayukcchukḷapakṣe cayāṣṭamī mūlasaṃyutā I
Sā mahānavamī nāma trilokyeƒpi sudurlabhā II 138-12 II

Kanyāgatesavitari śukḷapakṣeƒṣṭamī tu yā I
Mūlanakṣatrasaṃyuktā sā mahānavamī smṛtā II138-13II

[1] Gupte, B.A., 'Hindu Holidays and Ceremonials' p.179

The festival got shifted to Āśvina when the concept of Durgā got mixed up with Śāradā or Sarasvatī, personifications arising out of Śarad viṣu. Worship of Śārada, deity of Vidya, was a seasonal festival but Durgā was the personification of an epoch based on the sidereal zodiac and such the anniversary has to be reckoned as per the sidereal fixed zodiac to commemorate that historical event. Autumnal equinox has little to do with the Kanyā rāśi in symbolism with which Kanyā (Kumārī) pūja is performed during the celebrations.

3. Dīpāvalī

Dīpāvalī too depicts a humbug picture in the classical accounts: As we have only very little information about the prehistoric calendar traditions, it is difficult to establish a particular rationale as true in the absence of appropriate classical records. Even the purāṇas depict a comparatively later phase of evolution of the celebrations. If the present day conflict between different regional calendars is considered as an indication of the state of affairs in the past, it is likely that the year beginning as well as seasons were reckoned differently in different states of ancient India. As for example the equinoxes could have been the beginning or midpoints of the seasons Vasanta and Śarad and as such the seasonal year beginnings could have been one lunation behind the respective equinox. Mahābhārata depicts a calendar beginning with Mārgaśīrṣa but this does not provide any justification for Āśvina to be a month of festivals. Considering the epoch of 4137 BC, if there had been a tradition which considered the Śarad ṛtu as constituted by Kārttikā and Mārgaśīrṣa and the year began with Śarad ṛtu, then Kārttikā would have been the first month and Āśvina the last – a situation that could have made Āśvina a month of the festivities. Or, it is likely that Āśvina celebrations have their origin around 2000 BC when the year began with autumnal equinox / Kārttikā and Āśvina was the last month of the year. Legends involving Yama and Naraka suggest the possibility that the autumnal equinox did recede carrying the appellations of Mūla as mṛtyu, Asura etc., and the beginning of Pitṛpakṣa.

Aśvina Kṛṣṇa (14) is celebrated as, Naraka-caturdaśi and Kārttikā Śukḷa (1) is known as Balipratipada according to Dange[2]. Dīpāvalī extends over four days from Āśvina Kṛṣṇa (14) to Kārttikā Śukḷa (2). The fact that Narakāsura ruled over Prāgjyotiṣapura or Kāmākhyā and got defeated by Kṛṣṇa is suggestive of a conflict between Tāntric and Vedic cults or Śaivites and Vaiṣṇavites and the portrayal of the Tāntric calendar practice as an Asura.

Gupte has described the first day of Kārttikā as the New Year's day on which King Bali was made to give away the universe to Viṣṇu and abdicate himself while Pāṇḍuraṅga Bhatta in his book 'Dice Play in Sanskrit Literature' describes Bali-pratipada as: Yakṣa-rātri falls on the night of the new moon of Kārttikā and Dyūta-pratipada is the name given to the day which follows Yakṣa-rātṛi. Bali, the king of the netherworld ascended the throne on this day – the first day of the Indian calendar of Vikrama Era. The pratipada that follows the new moon of Kārttika can only be Mārgaśīrṣa Śukḷa (1) in amānta reckoning. According to legends Śiva and Pārvati played dice on this day – 'dyūta' being a cryptic reference to the act of fixing the calendar or Kālagaṇana in the Purāṇic literature, the

[2] p.502-503

theatre of the story can only be the junction of Jyeṣṭhā and Mūla, the seat of Mahākāla. Dyūta symbolically represents the Time with the throws Kṛtā, Tṛetā, Dvāpara and Kali and the principal akṣa (die) is known as Vṛṣa in synonymy with the Bull of Dharma that supposedly lost one leg each in the Yugas Tretā, Dvāpara and Kali.

It is possible that by the equation Agni = Rudra, autumnal equinox continued to enjoy the identity of Rudra in the purāṇic or mythological conceptions as it marked the year beginning even after it had receded from Mūla and hence a synonym of time. Whatever may be the true situation Dīpāvalī marked the New Year's Day as can be seen with the Vikrama Era and it is a matter of choice as to what should be the year beginning – Vedic literature itself abounds in references that suggests year beginning with either of the cardinal points. Those who want to follow the Tantric precepts have the year beginning with solar Dhanu, Mīna or Kanyā as was the practice in ancient days and may celebrate Dīpāvalī accordingly. Vaiṣṇava legends associated with the month of Kārttikā had their origin in comparatively later times when the summer solstice was at the Mithuna/Cancer junction and Cāturmāsya ended with nirayana Tuḷā – leading to Utthāpana of Viṣṇu and Kaumudi festival in Kārttikā.

4. Kṛṣṇāṣṭmī

Originally Kṛṣṇa-Janmāṣṭamī was the summer solstice and had the same rationale as Indra-mahōtsva or Vāmana Jayanti and Durgāṣṭmī all representing 'varṣādi' – the beginning of rains as well as the year. Purāṇas made all of them heroes except Indra, who went into oblivion after the advent of Vyāsa along with Bhāgavata/ the set of aṣṭādaśa Purāṇas and the Mahābhārata. As birth anniversaries all these have to be reckoned by sidereal reckoning i.e., Kṛṣṇāṣṭamī means the Kṛṣṇa (8) of the solar month of Kanyā while Durgāṣṭmī is Śukḷa (8) and Vāmana Jayanti is Śukḷa (12). Indra-dhvajā I have dealt with in detail and the celebration is actually summer solstice with which the year began. But the erroneous tradition has made it an anniversary reckoned sidereally and of historical significance rather than seasonally with religious significance. Those who want to pursue the Vedic tradition must honor Indra by celebrating the summer solstice day and the observances must reflect the fixed nakṣatra over which moon is placed on that day. In the year 2001 summer solstice falls on:

Dates of Indra-Mahotsav

Year	Summer Solstice		Moon		Nakṣatra	Tithi
	JD	Date: UT	λ	β		
2001	2452081.81861	June 21 07:37:40	87°34'	00°49'	Ārdra	Kṛṣṇa (15)
2002	2452447.05936	June 21 13:24:21	226°57'	02°43'	Viśākhā	Śukḷa (12)
2003	2452812.29968	June 21 19:10:23	02°04'	04°23'	U. Bhadra	Kṛṣṇa (8)
2004	2453177.54024	June 21 00:56:47	124°57'	05°05'	Puṣya	Śukḷa (3)
2005	2453542.78278	June 21 06:46:01	257°33'	04°14'	Jyeṣṭhā	Śukḷa (14)
2006	2453908.01871	June 21 12:25:45	38°06'	03°06'	Bharaṇī	Kṛṣṇa (11)
2007	2454273.25522	June 21 18:06:18	171°11'	01°01'	Phalguni	Śukḷa (7)
2008	2454638.50032	June 20 23:59:14	295°09'	02°07'	U.Āṣāḍhā	Kṛṣṇa (3)
2009	2455003.74072	June 21 05:45:23	67°50'	04°09'	Rōhinī	Kṛṣṇa (14)
2010	2455368.97883	June 21 11:28:16	209°34'	05°02'	Citrā/Svāti	Śukḷa (10)

Indra is approaching Ārdra now and in the year 2001 the summer solstice coincides with new moon and in 2002 with Śukḷa (12), as is the case with Indra-mahotsav. Vāmana Jayanti and Kṛṣṇāṣṭamī etc. are only particular solstices that due to historical reasons got personified and recorded in the Purāṇas.

Vāmana Purāṇa contains a record of the original epoch that metamorphosed in to the legendary birth of Kṛṣṇa:

Vāmana Purāṇa: 17.30-31:

Nabhasye māsi ca tathā yā sā Kṛṣṇāṣṭamī śubhā I
Yuktā mṛgaśireṇaiva sā tu Kālāṣṭamī smṛtā II
Tasyāṃ sarveṣu liṅgeṣu tithou svapiti śaṅkaraḥ I
Vasate sannidhānena tatra pūjākṣayāsmṛtā II

According to these verses, in the Cāturmāsya when all gods go to sleep – Śaṅkara sleeps in all the Liṅgas, on the eighth of dark half of Nabha or Bhādrapada known as Kālāṣṭamī when the moon is in conjunction with Mṛgaśīrṣa nakṣatra – and hence the worship of all liṅgas is productive of Śiva's grace. It is likely that this epoch that was originally a celebration or historically important epoch of the Tāntric cults was re-christened by the authors of the Purāṇas as the birthday of their hero of Vaiṣṇava Tantra.

5. Śivarātri

Śivarātri is celebrated on the 14^{th} of dark half of Māgha or the sidereal solar month of Kuṃbha. The original epoch in commemoration of which the festival is celebrated occurred in 4136 BC and the phenomenon recurs in every 160 years. Last time when the Mahāśivarātri coincided with the end-point of Kuṃbha is $13/14^{th}$ March 1945. Originally it was the winter solstice day that coincided with the boundary of Kuṃbha rāśi but since then the anniversary of the epoch is under celebration by sidereal reckoning.

Zodiac Fixed or Seasonal?

Discourses of Kaul convey the impression that every celestial object is continually undergoing displacement in positions due to precession or other phenomenon such as proper motion.* All that he speaks is correct with the micro fine computations of modern astronomy made on his computer but the fact remains that the stars retain their relative positions without any perceivable alterations in positions for many millenniums. Proper motion may bring in changes such as 1' in say 2000 years as has happened with Citrā but it is immaterial when the ayanāṃśas differ in themselves by 25^0. To expose the foolhardiness of those who pursue Citrapakṣa such silly arguments are not required at all. The whole astrological business including the one that Kaul profess i.e. tropical astrology is nonsense, as there haven't been any scientific studies in the field to ascertain the validity of the ancient wisdom. Between sidereal and the tropical zodiac the only

* 1999 Ephemeris: p.124 for instance.

difference is in terms of mathematical measurement – seasons and cardinal points can equally be observed and mathematically conceived in the sidereal zodiac also. As for example in the year 2000, the cardinal points were:

Cardinal points	JD	Tropical λ of Sun	Ayanāṃśa	Sidereal Longitude	Regressing on
Spring Equinox	2451623.81688	0^0	$24^0$35'34". 85	$335^0$24'25". 1	P.Bhadra
Summer Solstice	2451716.57554	90^0	$24^0$35'47". 62	$65^0$24'12". 38	Mṛgaśīrṣa
Autumnal Equinox	2451810.22824	180^0	$24^0$36'00". 52	$155^0$23'59". 4	U.Phālguni
Winter Solstice	2451900.06840	270^0	$24^0$36'12". 89	$245^0$23'47". 1	Mūla

Indra has already become a Mṛga or deer, like the Prajāpati of Vedic fame and is approaching Rōhiṇī while Varuṇa is set to become Rudra to shoot Indra who is chasing Rōhiṇī in the form of a deer. The Aitareya Bṛāhmaṇa legend[∞] had its origin quarter a precession cycle away i.e. nearly 6400 years back when the vernal equinox was in Mṛgaśīrṣa.

It is absurd to speak of the nakṣatras beginning with vernal equinox whether it is Aśvini or Kṛttikā. Kaul has interpreted Maitṛāyaṇi Upaniṣad 6.14 and Viṣṇu Purāṇa II.8.76-77as referring to sāyana nakṣatra divisions relying on the fact that Alcyone and Regulus are 90^0 apart. For the same reasons as cited by Kaul it can be suggested the verses describe a Nirayana zodiac with Kṛttikā or Alcyone as fiducial at 0^0or Regulus as fiducial at 120^0. All the Vedic listing of nakṣatras begin with Kṛttikā and as such there is strong ground to believe that the Ṛṣis conceived the zodiac when the vernal equinox had fallen over Kṛttikā or Alcyone and chose the same as the zero point.
On the other hand if Kṛttikā was the appellation given to the nakṣatra of vernal equinox, how can we identify the nakṣatra?

Vedāñga Jyotiṣa is a more authentic reference than all the Purāṇas (Kaul has quoted) about the dates of which we have no idea. VJ speaks of nakṣatra divisions and not stars and had Kaul been right in crediting Kṛttikā beginning to vernal equinox always, the summer solstice should have been always in the Maghā division i.e. the 7th from Kṛttikā, rather than at the middle of Āśleṣa or in Puṇarvasu. Most of the Purāṇas had their origin or redaction during the 3rd to 7th century AD when the Siddhāntic astronomy and its wrong notions had its prevalence and equinoxes were conceived as fixed to the beginning of Meṣa and Tulā. It was a period when the vernal equinox was imagined to have coincided with the sidereal zero point and therefore all mistook the tropical months Madhu, Mādhava etc. for the sidereal months such as Caitra, Vasiśākhā etc. Kaul himself has confused the Vedic calendar with the Zodiac, which is entirely a different thing – zodiac is

[∞] Dikshit, S.B., History of Indian Astronomy, Vol. I, p.52

the substratum over which the calendar phenomena such as equinoxes and moon's phases take place and such occurrences could have been recorded only against the fixed stellar background.

Computation of 'Vyatīpāta' and 'Vaidhṛta'

Pańcasiddhāntikā[1] Śḷokas 20, 21 and 22 of Chapter (III) gives the rules as follows:

Arkkenduyogacakre vaidhṛtamuktaṃ daśṛkṣasahitetu I
Yadicakraṃ vyatīpātō velā mṛgyāyutaibhogaiḥ II 20 II

"*When the sum of the true longitudes of the Sun and Moon equals one complete revolution there is the yoga called Vaidhṛta. When this sum plus ten Nakṣatras (i.e. $133^0 20'$) equals a complete revolution, then is the yoga called Vyatīpāta. Their time is to be found using the sum of the daily motions of the Sun and the Moon*".

Āśleṣārtthādāsīd yadā nivṛttiḥ kiloṣṇakiraṇasya I
Yuktamayanaṃ tadāƒƒsīt sāṃpratamayanaṃ puṇarvasutaḥ II 21 II

"*When the Sun began to turn south i.e. when the summer solstice was at the middle of the asterism Āśleṣā, the requirement of the definition that the Sun and the Moon should be in different ayanas was satisfied. But now the turning south takes place at three-quarters of Punarvasu. Therefore the definition has become faulty.*"

(Śḷoka does not imply 'three quarters of Puṇarvasu' - it implies only the Puṇarvasu division from 80^0 to $93^0 20'$)

Viparītāyanayātō yadāƒrkakāṣṭhāṃ śaśī savikṣepaḥ I
Bhavati tadā vyatipāto dinakṛcchśiyogacakrārthe II 22 II

"*With the Moon approaching to meet the Sun, moving in a direction opposite to that of the Sun, when its true declination (i.e. the mean declination plus its latitude) becomes equal to the Sun's and when the sum of their longitudes is nearly six signs, then is the "Vyatīpāta" conforming to the definition (i.e. the Mahāvyatīpāta)*"

(As above here also śḷoka does not suggest the term 'Mahā' attached to Vyatīpāta - it is only the translator's idea)

Mathematically śḷoka 20 defines:

Vaidhṛta correspond to: Sun + Moon $= 360^0$ →(a)

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[1] Pańcasiddhāntikā (Translation): T. S. Kuppaṇṇa Śāstry and K. V. Śarma

Vyatīpāta correspond to: Sun + Moon + $133^0 20'$ = 360^0 →(b)

And śloka 22 defines:

Vyatīpāta correspond to: Sun + Moon = 180^0 →(c)

It is apparent that the definitions of Vyatīpāta in (c) and (c) are different and hence the translator chose to describe (c) as 'Mahā-Vyatīpāta' to make a difference.

Present-day Practice in Nirayana Pañcāṅgas

The nirayana Pañcāṅgas published all over India compute Vyatīpāta and Vaidhṛuta using nirayana longitudes as per the definition (b) and (a) respectively. They are not at all bothered about the astronomical rationale of 'Parallel declinations'. As a consequence Vyatīpāta is the 17^{th} of the Yoga-series beginning with Viṣkaṃbha while Vaidhṛta is the last or 27^{th}. In fact if Vaidhṛta corresponding to Sun + Moon = 360^0 is the 27^{th} Yoga, then Vyatīpāta must be at the center of the series viz., 14^{th} being Sun + Moon = 180^0. The displacement of Vyatīpāta from the middle of the series must obviously be due to the use of nirayana longitudes in computation at a particular epoch. Equations (a), (b), and (c) can be reconciled if the same are considered with reference to the epoch of Pitāmahasiddhānta as described in śloka 21 i.e. the summer solstice at the middle of Āśleṣā ($113^0 20'$) r the winter solstice at Dhaniṣṭhādi ($293^0 20'$).

i.e. Ayanāṃśa =$23^0 20'$.

Now, the tropical sum of 180^0 as per (c) will be 180^0+ $46^0 40$ = $226^0 40'$ in nirayana computation, as the ayanamsa was additive. Sun + Moon = $226^0 40'$ was Vyatīpāta in nirayana computation. So the 14^{th} in the tropical yoga-series got shifted to 17^{th} in the nirayana system (i.e. $226^0 40'$/ $13^0 20'$ = 17). Similarly Vaidhṛta will be 360^0+ $46^0 40'$=$406^0 40'$ i.e. 31^{st} or 4^{th} in the series and hence both Vaidhṛta and Vyatīpāta are relatively at 13.5 Yogas (or 180^0) from each other.

Both the above computations as per (c) & (a) are in tune with the astronomical rationale of parallel declination. Relation (b) is practically the same as relation (c) because:

Sun + Moon + $133^0 20'$ = 360^0
I.e. Sun + Moon = 360^0 - $133^0 20$ = $226^0 40'$ (Nirayana)

In fact relation (b) is a variant of (c) so that Vyatīpāta is the 17^{th} of the series even at the time of Varāhamihira where-in Viṣu was supposed to be the beginning of Meṣa or ayanāṃśa was zero. At zero ayanāṃśa Vyatīpāta should have been the 14^{th} yoga irrespective of the sayana/nirayana method of computation.

It is evident from the above that the Yoga-series undergo alteration if we adopt the nirayana computation while it remains the same if we use sāyana longitudes. According to Bhāskara I:

"When the Sun plus the Moon equals six signs it is Vyatīpāta, when it is twelve signs it is

Vaidhṛta, and when it is equal to the distance of Anurādha it is the yoga of Sārpamastaka".

The present day computations are all absurd due to the deductive ayanāṃśa of roughly 24^0. Sun + Moon = 180^0 (Sāyana) means roughly 10 Nakṣatras only in the nirayana, but still we depict the sum of 17 Nakṣatras ($226^0 40'$) as nirayana Vyatīpātaṃ. In the same way Sun + Moon = 360^0 (Sāyana) means only 23.5 Nakṣatras in the nirayana but we describe 27 Nakṣatras as the Vaidhṛta in total contradiction to the relevant astronomical phenomena. For those who are not well versed in astronomy, I would like to quote from the Pañcasiddhāntikā translation by Kuppaṇṇaśāstry and K.V.Śarma, the description of the Phenomena:

"Thus in a year there are the two courses of the sun northward and southward (in respect of declination). In a given place, the exact point north or south where the Sun rises depends on its declination north or south. Like the sun, the Moon too, according to its declination rises north or south of the east point and has its Uttarāyana in about fourteen days and its Dakṣiṇāyana is about the same period, the total taking a little more than twenty-seven days. Now the day on which the sun and the moon rise almost at the point, one moving southward and the other moving northward, coming to meet each other as it were, that day is the Vyatīpāta. Because they cross each other moving in different directions, the phenomenon is called Vyatīpāta.

Predictive Astrology is non - Vedic

As Kaul has emphasized in the 1999 ephemeris 'predictive astrology is not Vedic at all' and to most Hindus who are proud of their heritage Jyotiṣa means today astrology only with no cognizance towards the necessity of performing Śṛāddhās and Pūjas at their proper times. As is the case with the definition of the sidereal zodiac or the astronomical rationale of Mūlādhāraṃ, we are totally unaware of the real purpose for which astrology was created and we live in a paradigm most unsuited to follow the Tāntric precepts and the path of Yoga wherein lie the secrets of Jyotiṣa. It is an exclusively occult discipline to be practiced only by Yogis towards the exploration of one's self rather than in assessing the materialistic prospects of a native for commercial gains. Today, shamelessly everyone describes astrology as 'Vedic' for enticing the public and to explore the commercial prospects and is the most dishonest activity in the world. The fact that none could dare to challenge Kaul point towards the lack of knowledge and lack of self esteem they themselves face in doing a most ignominious trade towards livelihood. The fact that astrology is practiced with zodiacs of bogus scientific foundations gives evidence for the fact that these people – practitioners and proponents – have no faith in the cannons of astrology they speak such as the power of planets or gods to make or mar one's prospects.

• Can anyone having faith in astrology and the powers of planets dare to publish a wrong Pañcāṅga or profess an erroneous Rāśicakra?

• Can anyone having faith in the Vedic/Tāntric precepts afford to practice his religion with a wrong Pañcāṅga and consider ignorance as bliss?

No one may care for these questions as a majority of the priesthood and astrological savants are not concerned about the "śāstraic" meanings or foundations of what they are doing. What we have as Jyotiṣa today is a most unscientific use of the astronomical data catering to the exploitation of the weakness of common man's mind in conjunction with the paraphernalia of innumerable remedies that defy all scientific and scrupulous perceptions of a discipline of science/humanities. Moreover those who style themselves today as astrologers and the so–called astrological scientists who exploit the common man through falsified astrological journalism have no grasp of astronomy or mathematics but they consider themselves as scientists on an equal footing with Bhāskarācārya or Newton on the ground that Bhāskara and Newton had practiced astrology. Any student of astrology may receive a severe jolt when he comes to know in the course of his study that innumerable mathematical abstractions of the ecliptic are under use in the name of Zodiac exclusively based on arbitrary choice. Divergent systems as "Tropical" and "Sidereal" and the multiplicity of the sidereal Zodiac may make even the most irrational of students wonder as to what kind of science astrology is and how unscientific is the practice of a religion that has produced a spectrum of sciences under its canopy.

Followers of the different schools of astrology preaching and teaching the same fundamental principles regarding planetary, zodiacal and house characteristics and functions but differing radically when it comes to mathematical conception of longitudes is nothing but an absurd corpus of literature that has come to accumulate over the ages under a pseudo-scientific paradigm of development and practice. To speak the truth there is no astrology in the Vedas or Vedāṅgas and as such the term 'Vedic Astrology' itself is a misnomer. In the true sense Jyotiṣa or Jyotirvigyān can never be translated as astrology, especially if we consider Jyotiṣa in the context of the Vedas. In Vedic tradition there was no astrology and Jyotiṣa meant the science of celestial phenomena or astronomy and utilization of the same for the purpose of forming a scientific calendar for regulation of life in tune with nature. If we consider for example Kerala – one of the cradles of Jyotiṣa at least since 7th century AD – the men who have nurtured the discipline of Jyotiṣa were all world class scientists/astronomers/mathematicians of their times and what we know today as astrology could have been only a favorite pastime of theirs as is evident from the voluminous works they have created on astronomy and mathematics.

In either of the traditions, Tāntric or Vedic, Gods shall never descent to save a society that has lost its faculties of reason and inquiry. Jyotiṣa does not profess any supernatural power in planets that makes or mars one's life or influence the worldly happenings in any way. It is a creative combination of mathematics and logic that renders a picture of the mysterious forces existing in our body and around us. A graceful life can be achieved by a scientific acceptance of the doctrines of Jyotiṣa and this is what both the Tāntric and Vedic traditions teach us. Conflicts and controversies shall cease when we resolve to accept the scientific spirit of reason and inquiry instead of submitting ourselves to the foolhardiness under perpetuation in many quarters in the name of religion and spirituality. Truth can be sought only by men of honesty and courage...!



X

ASTRONOMY OF EPICS

"How does a great civilization arise? Does it emerge full blown in a single episode of cultural transformation, or is it the final flowering of a long process that entails the patient accumulation of many innovations? These two possibilities are the extremes of a spectrum"

There were many Pleistocene ice ages, the glaciations of 18,000 years ago was the most recent... one third of the land was under ice sheets. In North America ice sheet was several kilometers thick at places and extended as far south as 35^0 N. Five percent of the earth's water was locked up in ice and the seal level was almost hundred meters lower than it is today. According to Milankovitch theory ice ages are caused by changes in the obliquity of earth's axis and the eccentricity/geometry of the orbit around the Sun.

Earth's rotational axis changes its inclination between 22.1 and 24.5 degrees in an obliquity cycle of about 41000 years.

Eccentricity of the orbit varies between 0.005 and 0.06 with a period of about 120,000 years

These two complications together leads to a major complication with a period of nearly 432, 000 years

X

ASTRONOMY OF EPICS

1. Introduction

Deciphering astronomy from an assemblage of myths and legends of uncertain date poses great difficulty in formulating conjectures and in establishing them to the satisfaction of scientific scrutiny. Rāmāyaṇa and Mahābhārata have been looked upon as historical in content at least partially by historians and in recent years with the rise of Hindu nationalism, such a line of thinking has assumed a new vigor and recognition in academic and social circles. But centuries of research and archaeological works have not yielded any reliable clues as regarding the dates of either of the epics or the drama that encrypted in it – we are at a loss even in understanding as to which of the epic drama preceded the other. Generally the Rāmāyaṇa is treated as the Ādikāvyaṃ and Vālmīki Ādikavi as may be noted from the following words of Professor Macdonell:

"*The original part of the Rāmāyaṇa appears to have been completed at a time when the epic kernel of the Mahābhārata had not as yet assumed definite shape. For while the heroes of the latter are not mentioned in the Rāmāyaṇa, the story of Rāma is often referred to in the longer epic. Again, in a passage Book VII (141,49) of the Mahābhārata which cannot be regarded as a later addition, two lines are quoted as Vālmīki's that occur unaltered in Book VI of the Rāmāyaṇa. The poem of Vālmīki must, therefore have been generally known as an old work before the Mahābhārata assumed a coherent form. In Book III (cantos 277-291) of the later epic, moreover there is a Ramōpākhyāna or 'Episode of Rāma', which seems to be based on the Rāmāyaṇa*".

As the 'original part' Macdonnel has meant the Rāmāyaṇa devoid of Uttarakāṇḍa, which appears to have been completed earlier as it has no mention of the heroes of Mahābhārata while Mahābhārata, Dṛōṇaparva VII.141.49 depicts a quotation of Vālmīki from Chapter VI of the Rāmāyaṇa and also contains Rāmōpākhyāna in Chapter III. Raychaudhury has challenged Macdonnell's assessment by quoting:

(i) Ādikāṇḍa X.2-3 where Kṛṣṇa Vāsudeva is alluded to
(ii) Ayōdhyā-kāṇḍa XIV.42, where Janamejayaḥ appears as a king of the bygone era
(iii) Ayōdhyā-kāṇḍa XXX.6 and Sundarakāṇḍa XXIV.11-12, where we find Satyavan and Sāvitri of Mahābhārata fame
(iv) Sundarakāṇḍa which mentions the characters of the Nalōpākhyāna of Mahābhārata

(v) Kiṣkindhā-kāṇḍa XIII.28 mentioning the acquisition of Pāñcajanya by Kṛṣṇa
(vi) Laṅka-kāṇḍa CXIX.15-27, which identifies Kṛṣṇa with Rāma
(vii) Laṅkā-kāṇḍa XIX.32; Mahābhārata II.41.9: 'Parigṛhyagiriṃ dorbhyāṃ vapur Viṣṇor viḍambayan'.

The historical conflict between the two topics can be well understood from the discussion of Raychaudhury:

"From the verses quoted above it is clear that the poem of Vālmīki is acquainted not only with some of the principal characters of the Pāṇḍu story, but also with the heroes and heroines of some of the finest Upākhyānas of the Great Epic. It may no doubt be argued that the verses in question are late interpolations, but such may also be the case with passages of the Great Epic, which contain references to the Rāma story. Professor Macdonnel does not assign any reason why the passage of the Drōṇaparva, which quotes two lines of Vālmīki's poem, cannot be regarded as a later addition. As the Śloka of Vālmīki occurs in a book which was "much expanded" (Hopkins, The Great Epic of India, p.62), it is not improbable that it is to be included in the "outer layer" of the Great Epic, i.e., the interpolated portions (ibid, p.79).

As regards the Rāmōpākhyāna we should note that the version of the Rāma story contained in it differs in many respects from that contained in Valmīki's poem. The Rāmāyaṇa (Uttara, IX.33-35) represents Rāvaṇa, Kuṃbakarṇa, Śūrpaṇaka and Vibhīṣaṇa as children of one and the same mother Kaikasī. The Rāmōpākhyāna (Mahābhārata III.274.7-8) on the other hand, makes Rāvaṇa and Kuṃbakarṇa sons of Puṣpōtkaṭā, Vibhīṣaṇa, the son of Mālinī and Khara and Śūrpaṇakhā the children of Rākā. Again the Rāmāyaṇa (VI.7) represents Rāma as the destroyer of Kuṃbakarṇa. On the other hand, the Rāmōpākhyāna (Mbh., III.26) represents Lakṣmaṇa as the slayer of Kuṃbakarṇa. These facts seem to indicate that the Rāmōpākhyāna is not based on the Rāmāyaṇa. Like the author of the Daśaratha Jātaka, the author of the Rāmōpākhyāna may have followed an independent tradition. In this connection we should remember that Vālmīki was not the first to attempt a Rāma Epic. A verse of the Buddhacarita of Aśvaghoṣa possibly records an unsuccessful attempt made by Cyavana, a predecessor of Vālmīki, to write the famous poem, which was to make the name of his illustrious descendant immortal.

Vālmīki-nādaśca sasarja padyaṃ
Jagraṃthayanna Cyavano Maharṣiḥ

We learn from the Mahābhārata (I.6.4) that Cyavana had the patronymic Bhārgava. Curiously enough, the Śānti-parva of the Mahābhārata (VII.40) cites a verse from Bhārgava's Rāmacarita. No doubt, Vālmīki too is called Bhārgava sattamaḥ in the Matsyapuraṇa (XII.51). But the verse cited in the Śāntiparva is not found in his poem, though it agrees in sense with Rāmāyaṇa (II.67.11). Some scholars, however, read Rāja-carita in the place of Rāma-carita and identify its author with Uśanas who was also a Bhārgava. But the fact that Vālmīki had his precursors is proved conclusively by the

evidence of the Ādikāṇḍa which tells us that the Ākhyāna called Rāmāyaṇa first originated with the Ikshvāku family and that Vālmīki knew Rāma only by hearsay:

Ikṣvākūnāṃ idaṃ teṣāṃ rājṅaṃ vaṃśe mahātmanām
Mahad utpannaṃ ākhyānaṃ Rāmāyaṇam iti śṛutaṃ [Ādi.V.3]

Ikṣvāku-vaṃśaprabhavo Rāmo nama janaiḥ śṛutaḥ [Ādi. I.8]

Hopkins (The Great Epic of India, p.60) draws our attention to the fact that neither of the two epics of Ancient India is recognized before the period of the Gṛhya-sūtras, and the first epic recognized here and in other sūtras is the Bhārata. But he says (p.385) that the oldest heroes of Bhārata are not of the Pāṇḍu family. He draws a distinction between the original Bhāratī-kathā and the Pāṇḍu story and says that the Bhāratī-kathā is older than Vālmīki's poem, but the story of Rāma is older than the story of the Pāṇḍus (The Great Epic of India, p.64). We should however remember that Janaka and Asvapati Kekaya, two important figures in the Rāma story as given by Vālmīki, are represented in several Vedic works as flourishing long after the Pārikṣitas, i.e., the great grandsons of the principal hero of the Mahābhārata. In the time of the Vedic Janaka the life and end of the Pārikṣitas were as pointed out by Weber, still fresh in the memory of the people and formed a subject of general curiosity. In the Bṛhadāraṇyakōpaniṣad (III.3.1) we find Bhujyu Lāhyāyani testing Yājṅavalkya, the ornament of the court of Janaka, with a question the solution of which the former had previously obtained from Sudhanvā Aṅgirasa, a Gandharva, who had in his possession the daughter of Kāpya Pataṅcala of Madra territory:

"Kva Pārīkṣitāƒbhavan?" "Whither have the Pārikṣitas gone?"

The solution of which, therefore appears to have been looked upon as extremely difficult. Yājṅavalkya answers, "Thither where all Aśvamedha sacrificers go".

The Pārikṣitas are Janamejaya and his three brothers, viz., Ugrasena, Bhīmasena and Śṛutasena (Vedic Index, I.p.520). They are mentioned in the following passage of the Mahābhārata:

Janamejayaḥ Pārīkṣitaḥ saha bhrātṛbhiḥ
Kurukṣetre dīrghasatramupāste tasya bhrāta-
rāstrayaḥ Śṛutasena-Ugraseno Bhīmasena iti [Mbh.I.3.1]

The Great Epic represents them as grandchildren of Abhimanyu, a prominent figure in the Pāṇḍu story.

It seems probable from what has been stated above that the Rāma story in which Janaka and Aśvapati Kekaya are prominent figures could not have originated before the passing away of the Pārikṣitas, i.e., Janamejayaḥ and his brothers. This conclusion is confirmed by the fact that Janamejaya is mentioned as an ancient hero in the Rāmāyaṇa itself (Ayōdhyā-kāṇḍa 64.42)…. On the other hand it is distinctly stated in the Mahābhārata

that the Pāṇdu story was older than that of Janamejaya, and was in fact recited before Janamejaya by Vaiśaṃpāyana...".

I have reproduced this brief account of the conflict between the contents of the two epics to illustrate the fact that neither of the epics is history as we understand by the term. No historic connection can be deciphered between the Dāśarathi Rāma and Vāsudeva Kṛṣṇa by a reading of the epics, which have assumed their present form since the formulations of Gṛhyasūtras and the Aṣṭādhyāyī of Pāṇini. The Bhārata, which finds a mention in the above, mentioned ancient works could only be the Bhārata[1] – saṃhitā of 24000 ślokas devoid of the Upākhyānas that contributes to the total of the legendary śatasahasrī saṃhitā. Raychaudhuri has further given the following details about the evolution of Mahābhārata:

" *...the Great Epic that has been extant since the days of Śārvanātha of the Khoch copper plate inscription of the Gupta year 214 (AD 533-534) is, as is well known, styled a Śata-sahaśrī saṃhitā and is interspersed with numerous Upākhyānas. Even so, the number of ślokas does not reach the total of 100, 000 verses. As pointed out by Hopkins in his Epic Mythology (p.2) the northern version contains 84, 126 verses excluding the Harivaṃśa. The southern version has 12,000 verses more than the northern recension and, without the Harivaṃśa, contains 96,578 verses or prose equivalents.*

Various theories have been suggested to account for the difference between the traditional number 100,000 and the number of ślokas in the extant versions of the Great Epic. According to some "the attribution of a lakh of verses necessarily implies the existence, as a part of the lakh, of the Harivaṃśa"[2]. But the addition of that work would make the total exceed the traditional number. This is particularly true of the southern recension. Others have argued that śata-sahasra is only a round number and is not to be taken too literally. But a third possibility cannot be entirely exclusded , viz., the loss or disappearance of some Upākhyānas which once formed part of the śatasāhasrī saṃhitā. It was the addition of the Upākhyānas, which transformed the original caturviṃśati-sāhasrī saṃhitā into a śata-sāhasrī saṃhitā. Is there any certainty that all these added Upākhyānas have come down to us?".

According to Hopkins:

"*The mythology of the two epics of India represents in general the belief of the people of Northern India along the lower Ganges within a few centuries of the Christian era. For the Mahābhārata the time from 300 BC to 100 BC appears now to be the most probable date, though excellent authorities extend the limits from 400 BC to 400 AD. The Mahābhārata as a whole is later than the Rāmāyaṇa; but R is metrically more advanced, the work of one author, a skilled metrician, who has improved the rougher epic form of the Mahābhārata, as his work represents a life less rude than that depicted in the great*

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[1] Caturviṃśati sahaśrīṃ cakre Bhārata-saṃhitāṃ I
Upākhyānair vinā tāvad Bhārataṃ procyate budhaiḥ II I.1.102 II

[2] Harivaṃśa according to E.W. Hopkins is of 16,375 (16,526) verses.

popular epic, this being the work of many hands and of different times. Both epics have received long additions. The germ of the Mahābhārata has been referred to the Vedic period and the Rāmāyaṇa has been assigned to pre-Buddhistic times (its gem also recognized as Vedic), but the data in part negative oppose the assumption that either epic poem existed before the fourth century BC.... It is most probable that Śānti and Anuśāsana were Books (XII and XIII) added to the original epic, but equally clear that they were included in the Mahābhārata containing a lakh of verses. They may be looked upon in general as later though not modern additions, yet as we know that one portion of Śānti has been enlarged in quite modern times, there should be no hesitation in granting that passages may have been added at any time within the last few centuries. The palpable additions made in the interest of sectarian belief in the southern recension are merely an indication of what has probably happened in both epics".

In the present discussion we are not bothered of the lost Upākhyānas that Raychaudhury has referred to. The point of interest to us in the above long extracts is the quantity apparent of the 'original' versus the 'extant recension' of Mahābhārata, 1:3, meaning, **two thirds of the contents are extraneous matter added to the original work – with all possible consequences of a very complex redaction process occurring stage by stage and epoch by epoch – perhaps in a way as to camouflage the original verses as well as their meanings**, to the chagrin of all those who may attempt to decipher and understand the purport of the original work. As noted earlier, in recent years people have attempted to read real history out of the epic/purāṇic accounts – a remarkable example is the use of genealogy apparent in such accounts without giving any cognizance to the early generations of mythological character. One of the detailed studies that has ever taken place on Purāṇic genealogy by R.M. Smith for example reconstructs the line of Naḷa as:

- Rāma→Kuśa→Atithi (?) →Niṣadha→Naḷa→Puṇḍarīka and
- Ṛtuparṇa as Nabhaga→Nābhāga→Ambarīṣa→Sindhudvīpa→Ayutāyus→Ṛtuparṇa

And treats Kārkōṭaka as mythologization of a historic personality or progenitor of the race that has come to be known as Kārkōṭaka Nāgas. Synchronism of the three is further used to date Arjuna Kārtavīrya to 1340 BC and the net result of the wholesome analysis of the dynasties was a date 975 BC for the Bhārata War. The absurdity of such reconstructions of dynasties lies in the fact that Naḷōpākhyāna of Mahābhārata is accepted as a historical narrative despite the astro-mythological connotations readily perceivable in the epic account. Similar is the case with the line of Bhīṣma:
•Jahnu→Suratha→Vidūratha→Ṛkṣa→Bhīmasena→Dilīpa→Pratīpa→Devāpi/Śantanu/Bāhlīka and the Purānic account quoted continues as: Devāpi went to the forest and became a seer→Śantanu became a king and a great physician→married Gaṅgā→begot a son Bhīṣma...all this is interpreted as history despite the absurd story line of a king getting married to the celestial Ganges and begetting a sun etc.

The epic and purāṇic accounts in fact contain the whole spectrum of mythology developed since the Vedic times and presents before us chaotic situation that makes a

chronological classification and identification impossible. The following words of Hopkins written nearly hundred years ago is quite enlightening in this regard:

*"The chief Hindu gods are phenomenal, Spencer's effort to prove that Indra and Dawn were originally ghosts being only the first of various attempts to distort translucent effects. The language of the early literature is too clear to be misunderstood in this regard. But by the time the epics were composed the phenomenal side was greatly obscured. Anthropomorphism had rendered even sun and moon quite human in dress, talk, and action while Indra was as much of a family man as Thor became elsewhere. But the base remained not wholly covered and even Viṣṇu and Śiva occasionally reveal their origin. Animism and naturism blend in the unification of spirits and objective matter marked by ancestors worshipped as animals, mountains, stars etc. But in one regard this chaos of mythology inherited from an older age is augmented rather than decreased by the generalizing process conspicuous in the epic. Namely, mythology has been affected by the star-cult, but to how great an extent is hard to say. All the stars were divine or saintly beings. Aldebaran was, as Rōhiṇī (female), the favorite wife of the Moon-god; the Pleiades were the "mothers" of Skanda; the Great Bear was known as the Seven Seers and Arundhatī, the wife of one of them waited nearby; the "steadfast" Dhruva (Pole Star) being less often personified in anthropomorphic form. But Dhruva is son of Nahūṣa, who in turn was born of Svarbhānu's daughter, Svarbhānavī by Āyu(s), the son of Purūravas and Urvaśī. Hence all Nahūṣa's sons, Yati, Yayāti, Saṃyati, Āyāti and Dhruva, meaning "going" like āyu, or "steadfast" may have been stars, the myth of Yayāti pointing in the same direction (I.75.25). So the Aśvins are born in "in the mouth" of the mare goddess (110), as asterism (?), Amāvasu (cf.amāvasyā) is also son of Āyu or Purūravas...**But most of this is lost in nebulous nomenclature.***

Another prolific source of gods is abstractions, constantly personified. There is no limit to a pantheon where hope, hell and hunger, cows and corn, the west and wisdom, etc are all called gods. Constantly new images invoke new personifications. Right and Wrong and Gain make an ancient triad regarded as divine beings, and the "wives" of these beings are registered, together with female attendants without number. Memory, Affection, Endurance, Victory, Effort are incorporate forms in the van of Skanda's army, nor can one dismiss them as poetic metaphor when on an equal footing with them stands Lakṣmī, Happiness, the well known wife of Viṣṇu...".

These words amply illustrate the caution required in accepting the episodes of the epics and purāṇas on their face value. We need to sift the accounts to clear off the spurious additions amounting to seventy-five percent for example in the case of Mahābhārata and also risk the danger of getting lost in the nebulous and/or cryptic nomenclature.

2. Mahābhārata and Rāmāyaṇa – Date of Creation

- Hopkins described epic mythology as – 'on the one hand touches upon that of the Purāṇas and on the other reaches back to the Vedic age' and is therefore not surprising to meet many Vedic gods under different guises in the Mahābhārata. Vedic connection of the epic is evident from Ādiparva II.267 that states – *Itihāsapurāṇābhyāṃ Vedaṃ*

samupabṛṃhayet – meaning 'Vedas finds their elaboration and interpretation in the epics and purāṇas'. To cite a specific example of such a classical elaboration of the Vedic terminology that had become cryptic with the passage of time we need only to look into the Pauṣyaparva where-in Upamanyu worships the Aśvinis, seeking deliverance from blindness. In modern times there have been many speculations as to what is the real identity of Aśvinis but none of such guess works can gain the authority inherent in Upamanyu's description which may be at least two millenniums of antiquity:

Prapūrvagou pūrvajou Citrabhānū girā vāffśaṃsāmi tapasā hyananthou I
Divyaou suparṇou virajou vimānāvadhikṣipantou bhuvanāni viśvā II 57 II

Hiraṇmayou śakunī sāṃparāyou Nāsatyadasrou sunasou vai jayantou I
Śukḷaṃ vayantou tarasā suvemāvadhivyayantāvasinaṃ vivasvataḥ II 58 II

Grastāṃ suparṇasya balena vartikāmamuńcatamaśvinou soubhagāya I
Tāvat suvṛttāvanamanta māyayā vasattamā gā aruṇā udāvahan II 59 II

Ṣaṣṭiśca gāvastṛiśatāśca dhenava ekaṃ vatsaṃ suvate taṃ duhanti I
Nānāgōṣṭhā vihitā ekadōhanāstāvaśvinou duhatō dharmamukthyaṃ II 60 II

Ekāṃ nābhiṃ saptaśatā arāḥsṛitāḥ pradhiṣvanyā viṃśatirarpitā arāḥ I
Anemi cakraṃ parivartatefjaraṃ māyāśvinou samanakti carṣaṇī II 61 II

Ekaṃ cakraṃ vartate dvādaśāraṃ ṣaṇṇābhimekākṣamṛtasya dhāraṇaṃ I
Yasmin devā adhi viśve viṣaktāstāvaśvinou muńcataṃ mā viṣīdataṃ II 62 II

[Pauṣya parva: Chapter-III]

Leaving aside the ornamental descriptions these verses depicts Aśvinis as sons of Vivsvān (sun) who in the form of sun weave the fabric of saṃvatsaraṃ with the strands of day and night. Further they are equated with time – the lone calf of 360 cows (milked by Aśvins) that creates and destroys everything. Upamanyu continue the description of the abode of all Devas related to time as wheel of 720 spokes joined to one axle and eternally revolving to cause the degeneration of all and pray to Aśvinis for deliverance from this wheel of time which holds the fruits of all actions.

It is apparent from the above that at the time when the extant version of Mahābhārata was under creation the Vedic Gods Aśvins were understood to be the personification of the twin-unit of time day and night, a 360 of which constituted the lone calf or 'ekaṃ vatsaṃ' i.e. The year.

- The episodes contained in the Mahābhārata can be the allegorical descriptions of the astronomical or natural phenomena of a vast period of time extending from the Vedic to the beginning of the Common Era, a period of probably three or four millenniums. As regards the date of a significant stage of formulation – we may call it rough – the initial sixty chapters which may be taken as introductory renders certain clues

regarding the epoch under which the chapters have taken shape. Pauṣya parva onwards depicts the story of calamity that fell upon the Nāgas led by Takṣaka, bosom friend of Indra, and denuded of the allegory the reign of King Pauṣya and doom of Takṣaka refers to the shift of summer solstice from Āśḷeṣā to Puṣyā. In terms of the principal stars representing these asterisms the solstice shifted from α-Cancri of sidereal longitude 109°3' [latitude: 5°5'] to δ-Cancri[3] of 104°8' [latitude: 0°5']. The epochs are respectively 1140 BC and 787 BC, i.e. the mythological reign of Pauṣya occurred in 787 BC when these initial chapters were given shape or added to the then existed version. If we consider the prevalence of zodiac and the nakṣatra divisions as the basis of the allegory rather than the principal stars, then the reign of Pauṣya can be credited to the epoch 969 BC and the period of Nāga as beginning in 1900 BC. Of course, the sarpasatra could have taken place only during the reign of Pauṣya.

The story of Uttaṅka that we find from Chapter III-98 to III-186, his conflict with Takṣaka and sojourn to Nāgalōka allows no other interpretation. The prayer of Uttaṅka places the Nāgas on the northern side of Gaṅgā and credits them with the ancestry of Irāvat and Dhṛtarāṣṭra followed by an allegorical description of time conceived as saṃvatsara.

Tṛīṇyarpitānyatra śatāni madhye ṣaṣṭiśca nityāṃ carati dhṛuvesmin I
Cakre caturviṃśatiparvayōge ṣaḍ vai kumāraḥ parivartayanti II146 II

This eternally revolving wheel of 360 spokes is consisted of 24 parvas and is run by six Kumāras.

Tantraṃ cedaṃ viśvarūpe yuvatyou vayastantūn satataṃ vartayantyou I
Kṛṣṇānsitāṃścaiva vivartayantyoù bhūtānyajasraṃ bhuvanāni caiva II 147 II

The two damsels with the black and white threads are constantly weaving the fabric of time over which we see the world and all its constituents.

Uttaṅka goes on to praise Indra in the Nāgalōka and finally with the aid of Agni in the form of a horse (actually Agni-pṛsthaṃ = year end?) brings Takṣaka to the heel and gets back the Kuṇḍalas of Pauṣya's wife and returns from Nāgalōka with wrath in his mind towards Takṣaka, and ultimately inspires Janamejaya who had conquered Takṣaśila earlier, to hold the sarpayajña. The reference to Takṣśila is very important – the place probably received its name after Takṣaka in 1900 BC when the summer solstice happened to fall on Āśḷeṣa – the nakṣatra that received the personification as Takṣaka – and it became a seat of learning under a king who patronized the worship of sun.

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[3] At present these stars are of visual magnitudes 4.25 and 3.94 respectively but that need not be the case around 1000 BC. Both or the former could have been a brighter one.

With a deeper look the story line may be summed up as follows:

Verse 82-84 depicts Janamejaya and Pauṣya accepting Ṛṣi Veda as their Guru → Guru leaves to perform yajña→ Guru's wife becomes ṛtumati→ Uttaṅka refuses to become a substitute of his Guru→ Uttaṅka leaves to get the Kuṇḍalas→ Pauṣya's wife gives them with the warning that Takṣka too aspires for those Kuṇḍalas→ Takṣka manages to lay his hands but Uttaṅka manages to get back them with the aid of Agni and Indra.

Deluded of the nebulous description Janamejaya can be identified with the sun, Pauṣya with the Year and their Guru Veda with Jupiter, the two conjunct Puṣya (representing solstice conjunct Puṣya) in fact heralded a new epoch in antiquity. The Kundala's of Pauṣya's wife or the luni-solar year are the solstices, which the Guru-patni (personification of Bārhaspatya year) longed for. Sarpayajña therefore took place after the adoption of the year or Yugādi with sun and Jupiter conjunct the solstice over Puṣya either at a full moon or new moon as we can find in the Mahābhārata evidences of year beginning with either the kṛṣṇa or śukḷa pakṣa[4]. As the nakṣatra of sun is never visible it would have been difficult to ascertain the star of solstice on new moon and hence the natural choice would have been full moon on Śṛāvaṇa to begin the solsticial year. One of the possible epochs can be located as full moon on Śṛāvaṇa[5] coinciding with summer solstice when Jupiter is heliacally set, using modern astronomical data:

Summer solstice of 964 BC: 2nd July, 15:11 UT: JD: 1369505.1324
Precession as per Mūlādhāra cakra = $16^{0}31'51''$ and the sidereal location of solstice = $106^{0}32'$
Full moon: UT: 1st July 964 BC, 22:44 and JD: 1369504.4472
Sun = $89^{0}22'$, Moon = $269^{0}22'$ and Jupiter = $89^{0}44'$ [tropical]
Sun = $105^{0}54'$, Moon = $285^{0}54'$ and Jupiter = $106^{0}16'$ [sidereal]
α-Cancri, sidereal longitude =$109^{0}3'$ and δ-Cancri = $104^{0}8'$.

It is apparent from the above that the summer solstice was almost exactly at the middle of Puṣya and the Sarpa and hence the conflict for the Kuṇḍalas with Takṣaka or the Nāgarāja. This location of the solstice explains Indra's support for both Uttaṅka and Takṣka i.e. Indra did not forego Takṣaka in favor of Uttaṅka or Janamejaya under whose auspices the sarpayajña was done afterwards.

- This determination of the date receives further support from the Parāśara's statement[6] that the Agastya or Canopus rises heliacally when sun enters the lunar asterism of Hasta and sets heliacally when the sun is in Rōhiṇī. In the northern latitudes such as Delhi, in the year 964 BC, Agastya rose when Sun was of tropical longitude 145^{0} [sidereally in Hasta] and set for a longitude of nearly 30^{0} tropical or 46^{0} sidereal, in Rōhiṇī.

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[4] Dikshit has quoted Vanaparva: 84.96 on page 111 of Bhāratīya Jyotiḥśāstra Volume-I
[5] Ādiparva: 71.34 point towards the conception of nakṣatra cakra beginning with Śṛāvaṇa, which had the winter solstice and as such the full moon on Śṛāvaṇa would have naturally implied summer solstice on Puṣya.
[6] Quoted by Bentley in 'A Historical Review of Hindu Astronomy', Part –I, p.54

- According to Karandikar Āśleṣā has received not only the appellation of snake but also of snake-pit and has quoted Kāḷidāsa in support who has used the term Vālmīka for Āśleṣā. This identification of Āśleṣā with Vālmīka is quite significant when we think of a date for Rāmāyaṇa, supposedly authored by someone born of Vālmīka and hence known by the name Vālmīki. The legend that describes the transformation of a robber into Ṛṣi involves the Saptarṣis (Great Bear) also and as such an astronomical identity for Vālmīka is not altogether improbable. This identification of Vālmīka shall place the formulation of Rāmāyaṇa too during the tenancy of summer solstice in Āśleṣā, may be a few decades or centuries before the Puṣya epoch determined earlier.

3. Caitra navami of Rāmāyaṇa

It is indisputable that the original profile of Rāma might have undergone changes or exaggerations at the hands of subsequent writers. So it is quite unlikely that we may be able to find an epoch that matches precisely with the birth details given for Rāma. In the antiquity of 964 BC also we can't expect very precise definitions of zodiacal signs etc. and due allowance needs to be given for such factors while looking at the heavens in search of the epoch that Vālmīkī has spoken about in Rāmāyaṇa. In proximity with the aforementioned date of Mahābhārata we can find:

Amānta Caitra beginning on 22nd March 964 BC[7] and Navami falling on 29 March 964 BC with the following planetary positions for the latter date:

29 March 964 BC 0:0 UT or 5:30 IST		
Planet	Tropical λ	Sidereal λ
Sun	$358^{0}41'$	$15^{0}13'$
Moon	$90^{0}31'$	$107^{0}03'$
Mars	$276^{0}53'$	$293^{0}25'$
Mercury	$19^{0}12'$	$35^{0}44'$
Jupiter	$71^{0}42'$	$88^{0}14'$
Venus	$355^{0}15'$	$11^{0}47'$
Saturn	$164^{0}44'$	$181^{0}16'$

Rāmā's birth in Puṇarvasu would have been true on the previous day, which of course would not have been truly navami as we understand the term today. But except for a little error[8] in the Jupiter's longitude, the planets Sun, Mars, Jupiter and Saturn can be taken as in their exaltation signs as we find stated in the extant version of Rāmāyaṇa. These planetary positions may be the kernel out of which the legendary horoscope of Rāma with five exalted planets took shape in subsequent times.

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[7] New Moon: 21st March 964 BC: 11:27 UT; JD = 1369401.9772

[8] Here the sidereal positions have been given strictly as per Mūlādhāra Cakra with Mūla as fiducial at 2400. In antiquity such as 964 BC, fixing up of the boundaries of signs would have been difficult and there might have been thumb rules to ascertain the planetary positions with respect to rāśis. As such the above positions are remarkably representative of their simultaneous exaltation stated in the Rāmāyaṇa.

Rāma – Personification of Spring Equinox

The kernel of the epic is calendar and astronomical phenomena couched in allegory and therefore the central point of the episode of Rāma's birth will be the year beginning on summer solstice under the Pūrṇimānta system. The error of Caitra-navami as equinox occurred probably because of back computation from the full moon that coincided with the summer solstice on the night of 1st July 964 BC. If we consider the solar motion from the new moon that preceded spring equinox to the summer solstice, moon covered 105 tithis in 98 degrees of sun and so if we compute back the tithi for 900 motion of sun (= 105*90/98 = 96.43) we get the tithi of equinox as 105 – 96.43 = 8.57 or the ninth one. Alternatively, the equinox to solstice was 94.25 days or say roughly as 95 days that constituted 96.5 tithis (i.e. +6.5) which when subtracted from the tithi of solstice (i.e.15) yields 8.5 or Navami for the spring equinox. Rāma thus personified the spring equinox corresponding to the Year beginning that coincided with full moon on Śṛāvaṇa and summer solstice on Puṣya. In other words, when the year began on Śṛāvaṇa Kṛṣṇa (16) the spring equinox coincided with Caitra śukḷa-navami. The epoch achieved significance as to undergo personification perhaps because of the assumption that the solstice on Puṣya and Śṛāvaṇa Kṛṣṇa (16) marked the midpoint of the sign Cancer and spring equinox of Caitra śukḷa navami was at the middle of Aries. The configuration repeated at intervals of 19 years and also roughly at intervals of 11/ 8 years and hence there were many Rāma epochs but the one of 964 BC achieved importance in mythological speculations because of the astrological significance of planetary positions.

Coronation (or Exile?) of Rāma – "Puṣyā Parva" of Rāmāyaṇa

Bentley has discussed the astronomy involved in this episode in the following lines:

"When Rāma attained the age of manhood, his father Daśaratha, in consequence of certain positions of planets approaching to a conjunction, supposed to portend evil, wished to share the government with him. Daśaratha says:

'My star, O Rāma, is crowded with portendous planets; sun, mars and the moon's ascending node (Rāhu).... Today the moon rose in Puṇarvasu: the astronomers announce her entering Puṣya tomorrow; be thou installed in Puṣya.... The sun's ingress into Puṣya being now come, the Lagna of Karkaṭa (Cancer) in which Rāma was born having begun to ascend above the horizon.... The moon forebore to shine; the sun disappeared while it was day'.

The facts pointed out here, show that there was an eclipse of the sun at or near the beginning of Cancer, at the moon's ascending node;(Rāhu being present) and that the planets were not far distant from each other. These circumstances, therefore, point out the time to have been the second of July, in the year 940 BC so that Rāma was then one and twenty years old. The following were the positions of the sun, moon and planets at that time.... It appears from what is above said that the beginning of Puṣyā and that of Cancer, were supposed to coincide; because it says that both the sun and moon entered Puṣyā; now the fact is that in the time of Rāma no part of Puṣyā coincided with Cancer. We are therefore led to this important conclusion that the beginning of Cancer and that of

Puṣyā coincided when the author of Rāmāyaṇa wrote that work and that he therefore concluded though erroneously that they were so in the time of Rāma…".

Bentley's conceptions of Rāma as a King and his data as well as the conclusions are all wrong. In fact it was not possible in his time with the algorithms he had to precisely ascertain the occurrence of a solar eclipse[9] in the antiquity such as 1000 BC. Further, in his conclusions he has exhibited his ignorance of the sidereal zodiac according to which Puṣyā was almost at the middle of Cancer as the ayanāṃśa was nearly 15^0. Even the planetary positions he has given do not satisfy the description given in Rāmāyaṇa that Sun, Moon, Mars and Rāhu were on Puṣyā (Sūryāṅgārakarāhubhiḥ).[10]

We saw above that the birth of Rāma heralded the introduction of the Śrāvaṇādi Pūrṇimānta system in 964 BC and the epochal configuration repeats at an interval of 19 years. The next major event of Rāmāyaṇa even though finds mention as coronation of Rāma, it was in fact exile – i.e. a new calendar came in force – which we can identify from the above description of the Puṣya epoch as the year beginning with Śukḷapakṣa on a day of eclipse in the month of Karkaṭaka when Karkaṭaka Rāśi itself was ascending on the horizon. These conditions are remarkably met with in northern India (Delhi) where a total solar eclipse took place on 3rd July 903 BC. At Ayodhya the sun rose at 05:00 LMT and the eclipse was total at 06:35 LMT with Mars heliacally set on Puṣyā.

For Delhi, the details are as follows:

Eclipse total at 01:09 UT on 3rd July 903 BC. JD: 1391785.547917. Sun = $90^0 38'$, Moon = $89^0 57'$, Mars = $89^0 42'$, Mercury = $114^0 54'$, Jupiter $131^0 29'$, Venus = $65^0 22'$, Saturn = $187^0 22'$, Rāhu = $85^0 25'$. Ayanāṃśa [Mūlādhāra] = $15^0 42'$. Sidereal position of sun as such will be 106^0 20' i.e. at the junction of the divisions Puṣya and Āśḷeṣā (Vālmīka). Sun, Moon, Mars, Rāhu were on Puṣyā.

These positions marked the coronation of Bharata and Rāma was exiled – the calendar represented by Rāma was Pūrṇimānta beginning with Pitṛpakṣa or Kṛṣṇapakṣa while the demand of Kubja or Manthara on behalf of Bharata was amānta beginning with Śukḷapakṣa – Bharata meaning "bearing the rays of sun" and the months were lunar named after the nakṣatra of full moon. In the former the year was solar seasonal linked to the vernal equinox but the latter was lunar and linked to winter solstice. Manthara who masterminded the exile of Rāma in favor of Bharata can be identified as the constellation Cygnus over which the full moon occurred 17 July 903 BC. This identification is based on the fact that Manthara is described as Kubja and both the terms mean hump-backed like a swan or Haṃsa and according to Bṛhatsaṃhitā Kubja refers to a class of attendants as

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[9] 2nd July 941 BC or (-) 940 (not 940 BC) as per the present notation of giving dates before 1 AD; New moon: Saturday, July 2, 06:39 UT: JD: 1377905.77713: Sun = Moon = $90^0 05'$, Mars = $48^0 43'$, Mercury = $77^0 16'$, Jupiter = $72^0 12'$, Venus = $99^0 04'$, Saturn = $90^0 45'$ and Rāhu = $99^0 39'$ [All tropical longitudes]. δT= TT-UT= $7^h 7^m 52^s.2$: Ayanāṃśa = $16^0 13'$. By adding this ayanāṃśa the sidereal longitudes can be obtained. Eclipse was not visible in northern India, New Delhi, Ayodhya etc.

[10] Ayōdhyā-kāṇḍa IV.18-22, page.210 of Gita Press edition 1998

is the case with Manthara's portrayal in Rāmāyaṇa. With the rising full moon at a south declination greater than 25^0, the eastern horizon had Pegasus with Cygnus higher up in the sky to represent both Manthara's original master Aśvapati of Kekaya and Manthara.

In the Rāmāyaṇa, Ayōdhyā [possessed of Iron] in fact represents the Earth, Daśaratha the Sun spanning the ten directions, His wives probably the Equator, Ecliptic and the Horizon – the celestial circles that bring forth the four children, the equinoxes and solstices. **The startling conclusion that emerges from an analysis of the allegorical 'Puṣyā episodes' of both Mahābhārata and Rāmāyaṇa is that both the descriptions have as basis the same astronomical epoch, the summer solstice of BC 964 falling at the junction of Āśḷeṣā and Puṣyā** [precisely at $106^0$32' as per Mūlādhāra Cakra]. Mahābhārata cryptically described the epoch at the outset as Puṣya-parva while Rāmāyaṇa depicted the author as Vālmīkī – Ṛṣi born of Vālmīka, a cryptic reference to Āśḷeṣā nakṣatra division of extent 120^0 to $106^0$40' over the sidereal zodiac.

In the Mahābhārata Parīkṣit is a cryptic reference to sun as the word can be interpreted as 'Pari+kṣata' meaning 'injured' or 'Parī+kṣiti' meaning 'going round the earth'. It is the former that is apparent in the cryptic story but in reality, he is the sole survivor of the Kuru race and is one of the many attires that sun takes in the Great Epic.

Āstīka Parva: Ṛṣi Śaunak, Sarpa, Kanya

Mahābhārata begins with a reference to the 12-Year Satra held by Kulapati Śaunaka at Naimiṣāraṇya where Sauti Ugraśṛavā presented the story of Mahābhārata before the assembled Ṛṣis. After Pauṣya parva, in Mahābhārata we see Śaunaka querying about the Sarpasatra held by Janamejaya and from chapter 13 to 59 the characters of the epic drama are mainly the serpents, and the contents include their origin as well ancestral details. This prefatory account of the Nāgas and Nāgakanyās in fact is an allegorical portrayal of the Pitṛyāna or Dakṣiṇāyana that follows the summer solstice. Ṛṣi Śaunaka is none other than the 'Dog star Sirius' which heliacally rises after the summer solstice followed by constellations Hydra or Kadru, Mother of all serpents, and the Virgo or Kanyā appearing in succession on the eastern horizon before sunrise as we proceed along the path of the Pitṛs. In terms of ecliptic longitudes Sirius or α-Canis Major – the brightest of the fixed stars – has a sidereal longitude of $79^0$30' and in the period preceding summer solstice of 964 BC it had been above horizon only during day time and was therefore not visible. As sun advanced across Āśḷeṣā and approached Maghā of Pitṛs, Sirius or Śaunaka became visible above the horizon before sunrise. Standard data puts the heliacal rising of Sirius in 1000 BC[11] approximately 105 days ahead of the vernal equinox or 11 days after summer solstice at a latitude of 30^0. Heliacal phenomena constitutes one of the basic rhythms of the sky and have been in tremendous use for calendar purposes in almost all ancient cultures like the Pharaonic Egypt, Maya etc. and is therefore not surprising to have played a role in India as well.

[11] In 2000 BC Sirius heliacally rose 96 days after the spring equinox, i.e. just the day after summer solstice at 30^0 latitude.

After one-and-a-half months on 15.08.964 BC new moon occurred at the fag end of Leo and **Maghā of Pitṛs** [Regulus or α - Leonis] and part of Hydra were visible above the horizon before sunrise. The principal star of Hydra α-Hydrae or Alphard rose exactly on the east with equator cutting the snake into two with α-Hydrae on the equator and was visible above the horizon before sunrise along with Maghā of Pitṛs. In Mahābhārata the phenomenon became the meeting of Ṛṣi Jaratkāru with the Pitṛs and his marriage with Vāsuki's (Equator personified as a snake) sister of the same name. α-Hydrae of magnitude 1.98 (nowadays) has a sidereal longitude of $122^0 42'$ and latitude of $22^0 23'$ and thus stood south of Maghā whose ecliptic longitude is $125^0 15'$ and latitude $0^0 28'$. Regulus rose half-an-hour early (towards 22^0 north) than α-Hydrae and almost $1^h 42^m$ before sunrise.

With further passage of time we see the heliacal rising of Crater, Corvus, Virgo and Spica till sun reaches the equator on the autumnal equinox on 2nd October 964 BC. Full moon and possibly eclipse[12] also occurred on 29th September. All the above constellations figure in the introductory chapters of Mahābhārata along with the Serpents in the form of Amṛtakumbha, Garuda, Mōhinī, Rāhu and Ketu etc.

4. Book of Genesis: Real beginning of Mahābhārata in the 63rd Chapter of Ādiparva

- Genesis of Uparicara, "Matsya-Kanya" Satyavati and Vyāsa

The story of genesis begins with Rāja Uparicara – the word 'Uparicara' meaning revolving or moving high up in the sky or in the north polar circle - and the King there is obviously Cepheus, who according to Greek legends was the father of the royal family of Ethiopia. His head is surrounded and illuminated by the celestial Ganges and Mahābhārata describes this as Vaijayanti gifted by Indra. In terms of ecliptic longitudes Cepheus ruled over the Matsya or Pisces as is evident from the following data:

Star	Sidereal λ	β
α-Cephei (m =2.44)	$348^0 12'$	68^0N55'
β-Cephei(m=3.23)	$10^0 58'$	71^0N09'
ζ-Cephei (m=3.35)	$349^0 23'$	61^0N09'
ι-Cephei (m =3.52)	$08^0 39'$	62^0N37
γ-Cephei (m =3.21)	$35^0 30'$	64^0N40'

In terms of celestial phenomena such as heliacal rising or achronal rising, Cepheus could have been of observational significance at either 1000 BC [heliacal rising at winter solstice] or in 4000 BC [achronal rising at summer solstice]. Association of Uparicara with Indradhvaja suggests the episode under description in Mahābharata as 4000 BC. In the northern latitudes such as Delhi the constellations that rose on the east around the time of summer solstice were Pegasus and Cassiopeia followed by Pisces, which quite

[12] New moon: JD (UT): 1369593.53501176:Wednesday, 29th September 00:50; Rāhu = $0^0 2'$, Moon: $\lambda = 356^0 45'$, $\beta = 0^0 18'$. Sun = $176^0 45'$.

appropriately reflect the story line of Mahābhārata. Cassiopeia was his wife Girikā and the five stars of Cassiopeia represented the five "Vasuputras" [sons of Uparicara] while the constellation Andromeda of the sign Pisces or Fishes stand for Adrikā, the nymph who had become a fish and Pisces, the children born of her – the King of Matsya and Matsya-Kanyā Satyavati. Pegasus rising simultaneously over the equator inspired the portrayal of Uparicara as a King constantly on horseback engaged in hunting.

Apart from the above major features the story line of chapter 63 provides a complete allegorical description of the horizon phenomena of 4136 BC and around by incorporating both Milky Way and the constellation Lacerta, the Lizard disguised as Śuktimati River and the mount Kōlāhala. Lacerta, the Lizard is a modern name given to the group of outlying stars between Cygnus and Andromeda but its area extend from the head of Cepheus to the left foot of Pegāsus with the northern half placed in the Milky Way amply justify its identification as Kōlāhala who stopped Śuktimati from flowing.

In the identification of some of the stars vis-à-vis mythological characters the articles by Śrī. P.G.Krishnan Nair offered a ready reference. I have crosschecked such identifications with astronomical literature on constellations before accepting the same. Nair has given the purāṇic account of Satyavati's birth based on Matsypurāṇa and Harivaṃśa, which may be given the following explantion:

Matsyapurāṇa, chapter-14 has the narration of Acchōda becoming Matsyakanya as a result of the curse of Pitṛs for her infatuation towards Amāvasu. Acchōda received the curse after doing penance in Pitṛsara as a river in pursuit of her infatuation for Amāvasu. The story line is reflective of the Pisces quarter of the zodiac where Ākāśa Gaṅga stands for the river in feminine form and the sign Pisces was the setting constellation when Regulus had its heliacal rise and marked the summer solstice around 4000 BC. Winter solstice had already entered Kuṃbha and as such it was impossible for Satyavati or Revatī to have it when conjunct new moon or Amāvasu. After being the wife of Śantanu she was to become the "Aṣṭaka of Sōmapathaṃ in Pitṛlōkaṃ" - which may mean the 8th tithi of the dark half of Moon. Here Satyavati is portrayed as perhaps the ecliptic star itself or the division Revatī, instead of the Mīna Rāśi. But in 4000 BC, the summer solstice could not have coincided with the Kṛṣṇāṣṭamī falling on Revatī as described in the Purāṇic account. Purāṇic account depicts the situation that had happened after being the wife of Śantanu in 4000 BC – that is, the authors have recorded the position at the epoch around 1000 BC where in summer solstice could have been on Kṛṣṇāṣṭamī falling on Revatī or east end of Pisces.

Citrāṅgadaḥ and Vicitravīrya

Related to Satyavati are her two sons Citrāṅgada and Vicitravīrya which respectively means 'stellar bangle' and 'wondrous lustre' and can be located in the sign of Fishes or Matsya. Directly below the great square of Pegasus is a circle or more correctly pentagon of stars known as circlet or western fish and this asterism received the name Citrāṅgada by virtue of its shape. Vicitravīrya of magnificent luster can be identified as Mira Ceti, the bright variable star close to α -Piscium which form the 'knot' (El-Rischa) that bind together

the fishes. This star played a double role as Citrāṅgadaḥ the Gandharva in view of its variable brightness.

64th Adhyāya: Amśāvataraṇa parva

It is important to note that the 64th chapter has presented the instruction of Brahmā to all Devas or shining ones/ stars for assuming appropriate births on earth to enable the process of establishing Dharma.

65th Adhyāya: Saṃbhava parva

Here we find the birth of Saptarṣis, Aditi and the Dakṣa-kanyās – all celestial beings. Kaśyapa, 12 Ādityas, Diti, Dānav, Hiraṇya Kaśyap, Virocanaḥ, Bali, Sun, Moon etc., are all born successively. Further Kaśyapa had 13 wives and Moon 27 and as far as the identity of these celestial beings is concerned there is no confusion in Mahābhārata. About the 27 wives of Moon, Mahābhārata says:

Saptaviṃśatiḥ sōmasya patnyō lōkasya viśrutāḥ I
Kālasya nayane yuktāḥ sōmapatnyaḥ śucivṛtāḥ II

There is no ambiguity or confusions as to the characters are all celestial beings and not the individuals who have created history on earth. 66th and 67th chapters elaborate the genealogy of Vasus, Rudras, Dharma and other Devas and also describe the birth of the Mahābhārata characters as incarnation of either the Devas or Dānavas.

• 95th Chapter: Clan of Bharata and Pāṇḍu from Dakṣa

As we saw Vālmīki in Rāmāyaṇa as an allegorical representation of the epochal summer solstice that has crossed the Vālmīka or Āśleṣā nakṣatra, in the Mahābhārata we find its legendary author Kṛṣṇadvaipāyana Vyāsa as the symbol of epochal winter solstice that had crossed the Matsya Rāśi or the sign Pisces. Astronomical origin of the clan cannot be missed by anyone as we find the story as - Kuru is born of Savaraṇa and Tapati (Vaivasvati: daughter of sun), Mahābhiṣak marries Gaṅgā etc. Many intermediary characters that find a mention in the epic are nebulous personification of Sun, for which specific meaning or interpretation cannot be thought of. One notable narration is of Śakunthaḷa and Bharata, the latter meaning of course sun[13] in the epic mythology. Śakunthaḷa can be identified as Praesaepe [ε-Cancri] (a faint star cluster) belonging to the Puṣya nakṣatra division (of the Pauṣya parva fame) that has been credited with the appellation Beehive or Bhṛṅgee by scholars such as Karaṇdikar. Allen gives the information that the Persian lunar station Avra-k, the Cloud, which according to brown included γ,δ,η and θ had the Coptic name Ermelia that meant "Nurturing".

• Identity of Śantanu, Gaṅgā and Bhīṣmā

As to what specific aspect of sun Śanthanu represents in the epic mythology can be gleaned from Mahābhārata IIIC.18:

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[13] Niruktaṃ VIII.13: Bharataḥ Ādityasya Bhāḥ

Pṛtīpasya tu bhāryāyāṃ garbhaḥ śṛīmānvardhata I
Śṛiyā paramayā yuktaḥ śāradśukḷe yathā śaśī II
Tatastu daśame māsi prajāyata raviprabhaṃ....

Śantanu, therefore is the autumnal sun that coincided with the bright half of moon and from the accompanying description of his hunting expeditions on the shore of Ganges the autumnal equinox of the time can be presumed as falling in Sagittarius.

Gaṅgā is obviously the celestial Ganges or Milky Way, which crosses the ecliptic at the junction of the constellations Scorpio and Sagittarius. Gaṅgadatta or the eighth Vasu or Bhīṣmā who stole the cow of Vasiṣthā is Mūla or λ-Scorpii, the fiducial star of the Hindu sidereal zodiac, Mūlādhāra Rāhu-Śikhi Cakra. In the 99th chapter Gaṅgā has identified Vasiṣthā in the following details mentioned to Śantanu:

Yaṃ lebhe varuṇaḥ putram purā bharatasattama I
Vasiṣṭhanāma sa muniḥ khyāta Āpava ityuta II

Tasyāśṛamapadaṃ puṇyaṃ mṛgapakṣisamanvitaṃ I
Merōḥ pārśve nagendrasya sarvaṛtukusumāvṛtaṃ II

This description places Vasiṣṭha on the side of polestar Thuban, as can be understood from the following sidereal positions:

Vasiṣṭha [Mizar: ζ - Ursae Major]: $\lambda = 141^0 07'$ and $\beta = 56^0 N23'$
Dhṛuva [Thuban: α - Draconis]: $\lambda = 132^0 52'$ and $\beta = 66^0 N22'$ Or,
ι-Draconis $\lambda = 160^0 22'$ and $\beta = 71^0 N06'$

Vasiṣṭha being described as Devarṣi, it can be understood that the solstice was east of Vasiṣṭha – this was possible only around 3000 - 4000 BC.

α - Draconis had its nearest approach to the Pole in 2831 BC while ι-Draconis had its maximum proximity around 4880 BC. In between these two epochs around 3500 BC, perhaps Mizar was looked upon as the north point of the celestial sphere and hence his dominance in mythology as the Devarṣi. The conflict between Mūla [λ - Scorpii] and Vasiṣṭha can be understood only if we consider a greater antiquity such as 5000 BC when the heliacal rising of Vasiṣṭha marked the summer solstice and Year beginning of a tropical calendar and Mūla marked the beginning of a sidereal calendar with Mārgśīrṣa as the first month. Vasu has stolen 'gāṃ savatsāṃ' (99.29), meaning 'Cow and the Calf' or Sun and the Year and hence the mythical birth of the star as Bhīṣmā and Śantanu made him invincible by granting 'Icchāmṛtyu'.

- **Birth of Pāṇḍavas, Bhīmā and Arjunaḥ**

The births of Bhīmā and Arjunah astronomically described in the epic provide valuable clues about the configuration of equinoxes and solstices at the epoch that forms the kernel of the allegory.

→ Bhīmā: Maghe candramasāyukte siṃhecābhyudite gurou I
Divāmadhyagate sūrya tithou puṇye trayodaśe II

→ Arjun: Uttarābhyāṃ tu pūrvābhyāṃ phalgunībhyāṃ tatō divā I
Jātastu phālgune māsi tenāsou phālgunaḥ smṛtaḥ II

It is apparent from the way Arjuna's birth is described that he is the personification of winter solstice falling at the beginning of Pisces [330^0] and the birthday corresponded to Phālguna pourṇamī while at Bhīmā's birth the tithi was Phālguna śukḷa tṛayodaśi coinciding with Maghā nakṣatra. In successive years winter solstice cannot fall on Trayōdaśi and Pourṇamī and Arjuna's mythological birth might be in the third year after Bhīmā's birth.

Saṃbhava-parva further renders an identification of the five Pāṇḍavas as akin to the Pańca-saṃvatsaras:

Anusaṃvatsaraṃ jātā api te kurusattamāḥ I
Pāṇḍuputrā vyarājanta pańcasaṃvatsarā iva II22II

Chapter 129: Birth of Kṛpācārya and Kṛpī: Symbolism of Mithuna Rāśi

A twin boy and a girl were born of Śaradvān (Archer) Goutama who has tried to run away from a nymph leaving the Bow, Arrow and Kṛṣṇājinaṃ behind.... Story reflects the symbolism of Dhanu-rāśi and the Mithuna-rāśi as well as Mṛga-nakṣatra. Almost similar is the birth legend of Drōṇa from Yajńa-kalaś, about which we have already referred to elsewhere.

- **Caitraratha – parva: Chapter 164 to 182 of Saṃbhavaparva**

Parva is named after the major character of the episode viz., Citraratha – stellar chariot or Charioteer – portrayed as a Gandharva engaged in water sports in the Ākāśa Gańgā, in Mahābhārata. Parva begins with a Brahmin storyteller from whom the Pāṇḍavas know of the svayaṃvara of Yajńasena and proceeds to Pańcāla to attend the same. Party was led by Arjuna carrying a torch to light the way and at the Sōmasṛayāyaṇa tīrtha Citraratha confronts them while attempting to cross the Gańgā. Citraratha also hold the name Ańgāraparṇa which means "fire winged" and claimed monopoly over the Ganges during the night. Storyline is reflective of the heliacal rise phenomena at the vernal equinox of around 4200 BC, involving the constellation Aurigae, the Charioteer whose heliacal rise

heralded the vernal equinox. In terms of ecliptic longitudes the important stars of the sector are:

Star	Sidereal λ	β
α-Aurigae	$57^0 16'$	22^0N52'
η-Aurigae	$54^0 52'$	$18^0 17'$
ζ-Aurigae	$54^0 03'$	18^0N12'
ε-Aurigae	$54^0 15'$	20^0N57'
ι-Aurigae	$52^0 03'$	10^0N27'
λ-Orionis	$59^0 07'$	13^0N22'
β - Tauri	$57^0 59'$	05^0N23'
β - Leonis	$147^0 02'$	12^0N16'

β-Tauri (known as Agni) represented the torch that Arjuna held and it heliacally rose along with Aurigae lying on the galactic equator. Aurigae lying in the Milky Way represented Citraratha and his company of nymphs engaged in water sports. The confrontation occurs during their journey to meet Yajñasena, Pāñcāli born of the sacrifice by Drupada – one of the Twins that emerged from the Yajña. Equinoctial years often received the appellation of Prajāpati or Yajña in Vedic times and the above story refers to the twins arising out of Yajña, obviously the author of the allegory had in his mind the zodical sign Gemini and the epoch is around 4137 BC when the equinox marked the boundary of Taurus and Gemini.

Citraratha was located at Sōmāśṛayāyaṇaṃ - an allegorical reference to the star Mṛgaśiras also known as Sōma, the λ - Orionis. Citraratha is referred to as Aṅgāraparṇa as Agni [β-Tauri] forms a part of Aurigae. Role of Agni is further apparent in the conflict:

→ Arjuna defends himself with the torch [Agni] he had.
→ Arjuna destroys the chariot with Āgneyāstraṃ - born of Bṛhaspati and Bharadvāja - given to him by Dṛōṇācārya.
→ Defeated Citraratha forsakes his name “Aṅgāraparṇa”.
→ Astronomically when the star Agni was rising β- Leonis or Uttara Phālguni that represents Arjuna was at the nadir and at the time of sunset when Aurigae sets Arjuni occupies mid-heaven.

Citraratha spoke thus after his defeat:

Astrāgninā vicitrōƒyaṃ dagdho me ratha uttamah !
Sōƒhaṃ Citraratho bhūtvā nāmnā dagdharathōƒbhavan II 169.40 II

In the rest of the episode Citraratha describes to him the story of Saṃvaraṇa and Tapati followed by that of Vasiṣṭhā and his clan, all stars of Leo, which had summer solstice in 4000 BC. Aurva's discussion with Pitṛs (Maghā) and the stars of Leo in various roles as

Vasiṣṭha and his sons, Rākṣasa Kalmāṣapāda, Rākṣasa-satra by Parāśara all suggests the summer solstice heralded by the heliacal rising of Leo and neighbouring groups as the source of the story. Kalmāṣapāda, the Rākṣasa who had eaten the hundred sons of Vasiṣṭha can be identified as the Coma Berenices or Berenice's Hair lying behind the Lion's tail and the hundred sons are the star cluster of the same name.

Aurigae appear in the Mahābhārata also as Jayadratha – the King of Sindhu – who prevented the escape of Abhimanyu from the Cakravyūha. Aurigae and Perseus in fact formed a 'Gate' in the heaven (above Orion) and hence the above story line of Jayadratha closing the exit point of the Cakravyūha, which is the zodiac itself. Around 4000 BC, at the time of autumnal equinox Aurigae and Pegasus could be seen on the eastern sky after sunset and so all the luminaries had to move past the 'Gate', which Jayadratha formed in the heaven at the junction of the ecliptic and the celestial and galactic equator. The fact that Pāṇḍavas have been repeatedly under confrontation with Aurigae in various guises suggests the authors of the allegorical account considered Pāṇḍavas as representation of the five Kujādi Tāragrahas.

Searching for astronomical allegories among the hundred thousand verses of Mahābhārata is a gigantic task. Some of the related episodes like the Mahābharata War will be discussed separately in a succeeding chapter. Further research is under progress to understand the specific location at which the astronomical observations have been made and to ascertain as to whether the authors have followed any chronological scheme in placing the various episodes.

5. Genesis of Rāma in Rāmāyaṇa

Bālakāṇḍa of Rāmāyaṇa provides a vivid account of the circumstances in which four sons were born to Daśaratha. In the ninth Canto Charioteer Sumantra recollects the prophecy of Sanatkumāra before the king that his son-in-law Ṛṣyaśṛṅga shall get him sons by performing Aśvamedha. After the completion of an year –"punaprāpte vasante tu pūrṇaḥ saṃvatsarō∫bhavat" – when the horse returned Daśaratha met Vasiṣṭha and Arundhati for their blessings and as instructed by him invites kings of Kekaya, Magadha, Aṅga, Sindhusauvīra, Saurāṣṭra and south for the sacrifice. Sacrifice was performed on the northern bank of Sarayū and twenty-one sacrificial pillars were erected which shone like the constellation of Great Bear. At the end of the sacrifice by Ṛṣyaśṛṅga Viṣṇu decides to have his descent at Ayodhya as the four sons of Dasāratha.

We have seen earlier the meaning of Aśvamedha in the context of calendar. Leaving aside the details of the sacrifice, it is easy to realize that the story is a cryptic commentary on some calendar reform that took place in antiquity. The name of the Ṛṣi, Ṛṣyaśṛṅga itself offers the necessary clue: Ṛṣyaśṛṅga literally means 'having the horns of an antelope' or it is a term equivalent of 'Mṛgaśīrṣa', the 5th constellation of the Hindu zodiac. Charioteer of Daśaratha who speaks of the prophecy of Sanatkumāra may be identified with Aurigae and as regards Vasiṣṭha and Arundhatī, there cannot be any confusion. According to Padmapurāṇa during the Aśvamedha performed in Rāma's reign he had to be in a state of consecration for a year holding the horn of a deer. This significance of

Mṛgaśiras in the Aśvamedha or sacrifice of the sun arises out of the fact that the heliacal rising of Bellatrix or γ - Orionis marked the summer solstice. In the sacrifice performed by Daśaratha, the number of beasts sacrificed were 300, which considered as the days after summer solstice takes sun to the end of the spring season marked by transit over Rohiṇī or Prajāpati and this fact got allegorically described as the appearance of Prajāpati or Viṣṇu as Nara at the end of the Putrakāmeṣṭi sacrifice.

PG Krishnan Nair's Work on Rāmāyaṇa

His name I have already referred to in some earlier sections. Mr. Nair has published a number of articles in vernacular Malayalam in which astronomical identity of many of the characters are available. Despite some inconsistencies and the description of the astronomical phenomena devoid of a precise epoch, its contents offer a lot of food for thought. Coupled with the epoch I have determined for Śri Rāma viz., Vernal equinox of 964 BC, a more consistent picture is attempted below to annul the Egyptian-Greco-Babylonian profile of astronomical origins.

• Daśaratha is Sun who spans over the 10 directions

• Śrī Rāma too partakes the features of Sun but represents a calendar beginning at the vernal equinox and Rāmāyaṇa is the allegorical profile of the six months of Devāyana in which Sun is in the northern hemisphere.

• Precisely the vernal equinox was at $16^{0}32'$ of the sidereal zodiac [Mūlādhāra Rāśicakra], which in ancient times might have been approximated as the middle of Aries or Meṣa.

Rāmāyaṇa or the Course of Rāma

→ Ayōdhyā – Middle of Aries: Middle of spring season: Pṛthvi is the location of Vasantha & Śarad and they represent the Kingdoms/ populace as per Niruktaṃ

→ Grīṣma and Hemantha represent atmosphere and forests, nature in its fury. Rāma leaves Ayōdhay for forest as Sun advances to the Grīṣmaṃ that begins at the middle of Vṛṣbha or over Rōhiṇī.

→ New moon happens on Kṛttikā and the Kṛṣṇpakṣa probably got personified as Tamasā river and in the same 'night' or dark half Sun reaches the Gaṅgā.

→ Between Rōhiṇī [Aldebaran] and Citraratha [Capella] Sun finds the Gaṅgā after which the forests begin. Guha, the Niṣāda King of Śṛṅgaverapura who takes Sun across the Ganges 'next morning' or bright half [14^{0} transit of Sun] in his boat is Alcyone [Kārttika] as is evident from the appellation Guha of Lord Kārttikeya.

→ After crossing the Gaṅgā, Rāma enters the forest and finds smoke – flag of Agni – an

allegorical reference to Elnath [β- Tauri: 57°59'] and then reaches the hermitage of Bharadvāja in Prayāga, between the Gaṅgā and Yamunā. Bharadvāja's Āśrama is probably the Puṇarvasu ruled by Jupiter.

→ Yamuna may be ecliptic or the sign Cancer that has another branch of the galaxy and there another boat is used and as suggested by Bharadvāja Rāma walks further south to reach Citrakūṭ where Vālmīki has got his Āśraṃ. The terms Citrakūṭ and Vālmīki are quite significant – Citrakūṭ may mean a serpent house or literally 'star puzzle' and Vālmīki as explained earlier means the Āśleṣā nakṣatra. From the eulogy made of the place in the Rāmāyaṇa, it is evident that it was the location of summer solstice. For solstice Sun was in rapt conjunction with Jupiter and perhaps this conjunction was interpreted as a meeting with Bharadvāja and his guidance to move towards Citrakūṭaṃ - the precise location of solstice. The maximum declination at the solstices has given the description of a mountain peak [Meru] for the location of solstices.

→ As explained earlier, solstice was sidereally at 106°32' - almost midway between δ-Cancri [Puṣya: 104°08'] and α-Cancri [Āśleṣā: 109°03'].

• Rāmāyaṇa apparently depicts a mix-up of the description of the solar course from vernal equinox to autumnal equinox and the heliacal phenomena at equinoxes and the solstices. Heliacal phenomena at the vernal equinox got described as the palace intrigues at Ayōdhyā with the major characters:

→ Square of Pegasus: Aśvapati, King of Kekaya country
→ Andromeda: Kaikeyī, daughter of Aśvapati and mother of Bharata [Perseus]
→ Perseus rising heliacally after the great square and Andromeda became Bharata
→ Cygnus, high up in the sky became the hunch-backed Manthara

→ As sun advanced further, the constellations Ursae Major [Seven Sages] and Canis Minor and Canis Major heliacally rose followed by Agastya [Canopus] for southern latitudes. These constellations find mention in the story respectively as Atri [one of the seven sages], Sutīṣṇā [Procyon,] Virādha [a monster holding different creatures: Sirius surrounded by many animal figures like monocerotis, Lepus, Puppis etc.], and Agastya. Agastya guides him to Pañcavaṭi, where Rāma meets with Śūrpanakha and Khara [Ass], which are the Monocerotis and the γ & δ Cancri known as Asses.

→ Rāma saw Agastya from the Āśrama of Sutīṣṇa [Procyon] – this is impossible if it meant the longitudinal transit of sun over Procyon. In fact Agastya becomes visible only after Procyon gains considerable altitude for New Delhi. According to Agastya, Pañcavaṭi was in the north, beyond the trees of ambrosia in Gemini and Lynx when viewed from the southern location of Canopus - the direction opposite to the one Rāma had traveled to

reach Citrakūṭaṃ. This change of direction in the course of Rāma is evidently due to the description of the heliacal phenomena of the period after summer solstice.

→ Pañcavaṭi, is the constellation Aurigae made up of five stars on the side of the galaxy which appear here as Godāvari and the principal star α-Aurigae approaching its upper transit around the time of sunrise – after a month from the solstice for New Delhi. Same constellation also appears as the Puṣpaka flying chariot of Rāvaṇa in which he took away Sīta.

→ Towards north of Pañcavaṭi Rāma could see Pṛśravaṇa mountain – author may be referring to the winter solstice located in that direction from where the Uttarāyana had the beginning – and Agastya was in the southerly direction. Incidents at Pañcavaṭi took place between Aurigae and Canopus where we can find the Mārīca [Mṛga in Orion], Jaṭāyu [Monocerotis], and Sirius, Leporis and Columbae constituting the other creatures that confronted Rāma.

→ Moving further, Rāma meets Śabari, Vindemiatrix [drākṣa-kanyā] at the beginning of Virgo.

→ Rāma's course over the ecliptic is described in terms of Mātaṅgaśrama and Kiṣkindha which form the northern precincts of Leo while Ṛṣyamūkācalaṃ where Sugrīva takes refuge is Ursae Major, the Saptarṣis. Coma Bernices could be imagined as elephant leading to the name Mātaṅgavana for the area and the monkeys may be located in Urase Major. Bāli can be identified as the full Moon of autumnal equinox that set eclipsed. Or may be some other object over the ecliptic like Saturn who was near Citrā [Spica]. There is confusion in the profile given that makes a unique identification impossible. Sugrīva is mentioned as son of Sūrya and Bāli son of Indra but these descriptions make no sense in the signs Virgo and Libra. May be they respectively represented the solar and lunar months vis-à-vis calendar and the lunar calendar was abandoned in favor of a solar one after the autumnal equinox that nearly coincided with full moon on Aśvini.

• The 'ayana' described should have ended with the autumnal equinox as the six months are over. But the story – may be because modifications over a long course of antiquity – is devoid of such a precise astronomical time frame. So it is recorded in the Rāmāyaṇa that Bāli was killed before the month of Śṛāvaṇa and the monkeys will set off in search of Sīta after the rains with the advent of Kārttika. In fact a sojourn over Kārttika cannot be avoided as the seat of Nirṛta Rāvaṇa is at the junction of Scorpio and Sagittarius, i.e., solar months of Kārttika and Mṛgaśīrṣa. But Nirṛta Rāvaṇa had sway over the Laṅka on equator only in 4137 BC when the equator passed over Mūla. This in fact suggests that the source of the story is not exclusively the epoch of 964 BC, it is related to the original epoch of sidereal zodiac by some astronomical tradition. The shift of the autumnal equinox to Āśvina pourṇāmi was not properly incorporated in the stòry. [Āśvina pourṇāmi was three days before the autumnal equinox and so the moon was in Taurus for the moment of equinox. Bharata considered as Moon was obviously in Nandi-grāma [Nandi ≡Bull], waiting for the epoch of Rāma to turn up].

• Or, may be that the story incorporates the phenomena over the whole of zodiac – not precisely of any half year. Even though Rāma's horoscope and the allegory of palace intrigues had their origin in 964BC, the description of solstice that we find in the epoch stretches over a long period of time prior to that. This is evident from the story line that Rāma begins the final journey to south in Śrāvaṇa śukḷapakṣa[14] beginning with Uttaraphālguni nakṣatra, as the days gradually became shorter and reaches Māhendra Mountain [allegorical reference to summer solstice] in due course. This is possible only around 4000 BC. A supporting fact is that it is after Rāma's arrival at Māhendra that Rāvaṇa orders for the waking up of Kuṃbhakarṇa, which must coincide with the beginning of Dakṣiṇāyana[15], day of the demons.

→ Rāma's victory over Rāvaṇa is depicted as on Āśvina Kṛṣṇa [10] or Vijayadaśami – this is an impossibility when the monkeys had set off in search of Sīta in the month of Kārttika. This mix up is due to the reasons I have already mentioned – shift of autumnal equinox over Rāvaṇa's Laṅka from the end of solar Kārttika in 4000 BC to the middle of solar Āśvina in 1000 BC.

→ Sīta is the personification of Ākāśagaṅgā. As sun leaves Aurigae [Pañcavaṭi], he is able to meet her only after crossing Mūla, which is at the galactic center. This is the reason for the legend that Sīta was the daughter of Rāvaṇa, born in Laṅkāpuri and abandoned on the advice of Brahmarṣi Nārada.

• Author of the story is Vālmīki – solstice transiting over Āśḷeṣa. The twin sons of Sīta who is brought up in his Āśṛama are the stars Castor and Pollux, the stars that heliacally rise at the summer solstice. Cardinal points constituted the four sons of Daśaratha – Lakṣmaṇa: summer solstice and Bharata that of winter.

• The astronomical interpretation of the epic episodes attempted here in forms only an insignificant part of Ramāyana and Mahabhārata. Further studies are required to understand the trur depths of astronomy contained in these great works.



[14] This must be of the Pūrṇimāntha system and may be Adhimāsa.
[15] This is a wrong identification that was prevalent since ancient times. Actual Dakṣiṇāyana that is the day of the demons is from autumnal equinox to vernal equinox, when the sun is in the south of equator.

XI

ON THE TOUCHSTONE OF ESTABLISHED NOTIONS

•Milky Way is the galaxy of which our solar system forms a part and its centre is located near 2^0 Sagittarius. The starry band that gives the impression of a milky ocean extends between 25^0 Taurus and 10^0 Cancer to 12^0 Scorpio and 21^0 Sagittarius. In reality, it is a huge wheel like structure hundred thousand light years in diameter and ten thousand light-years in thickness.

•"From the God of knowledge is everything that is and that will be, and before they were, he prepared their complete plan and when they are, they fulfill their task according to his glorious plan, and it cannot be changed"

Some 70 million years ago India and the rocks that now make up the Himalayas were about 8,000 kilometers south of their present position, drifting northward from the Antarctica towards Asia on a large plate consisting primarily of oceanic lithosphere. Southern Tibet was at that time on the south coast of Asia and lay about 2,000 kilometers south of where it is now. As the Indian and Eurasian plates collided the oceanic lithosphere north of the Indian landmass was bent down and thrust under Tibet… Geologists call this process subduction… sometime between 55 and 40 million years ago the Indian landmass itself struck the south coast of Asia … India plunged under Tibet with tremendous force … (leading to the rise of Himalayas).

XI

ON THE TOUCHSTONE OF ESTABLISHED NOTIONS

Despite the half-a-century that has passed since political independence, in India history of science still remains latched up in archaic notions that look upon the Vedas, Epics and Purāṇas in terms of *prmitive imagination, prehistory, Aryan invasion, prevedic Harappa, Gangetic spread of Vedic Aryans, Aryan spread towards south as detailed in Rāmayaṇa* etc. We have atmost faithfully followed the paradigm initiated by European Missionaries under the patronage extended by the so-called socialist minded power centers of independent India. In history, where the role of scientific scrutiny is limited, a milieu has evolved during the last few decades that has only contempt for any creative appreciation of Indian's heritage and they tend to hold sway over many instituitions and their concoctions remain the touchstones of academic excellence in historical research. Many of the champions of this school, during the last 50 years have only parroted what they have learned from their illustrious 'socialist' predecessors with no independent contributions of their own. For some of them history of science is only a pastime meant to sustain and promote their pet pseudo-intellectual notions. They are not bothered about the developments in other parts of the World and remains stuck to what they have learned may be twenty or thirty years before in their school days. With such knowledge they have come to carry out responsibilities as academicians and the net result is poor guidance and research output as may be understood from the recent developments in the decipherment of Indus script. Scholastic acumen of India, in general, remains incapable of even identifying and appreciating a true decipherment because of the reason that the true decipherment stands to drive their pet notions to their ultimate doom. The greatest of the ancient civilizations as a result remains devoid of a literature and the greatest of the literary heritage is bereft of any material evidence.

• In the words of J.P.Joshi:
"The issue basically pertains to the date and authors of the Vedas, especially Ṛgveda, and original home of the Aryans, although in archaeological parlance we have nothing in the material remains unearthed so far which could positively be associated with Aryan or the Vedic people".

• According to Rajesh Kochhar:
"There is no material culture in India that can be explicitly associated with the Ṛgvedic people. As for the post-Ṛgvedic period of the Brāhmaṇas and Sutras, there is unanimity in associating it with the Painted Grey Ware. There is however nothing at the PGW sites that can be explicitly associated with the literary texts or vice versa. In fact these sites come nowhere near their picture painted by the epic. The Mahābhārata's Hastinapura is the famed capital of the Kurus. The archaeologist's Hastinapur is a small village where people lived in huts and bred cattle...The Mahābhārata's Indraprastha is a PGW site whereas the Rāmāyaṇa's Ayodhya belongs to the NBPW culture, which succeeded

PGW. This is curious because, according to tradition, the Rāmāyaṇa preceded the Mahābhārata ...how do we resolve this paradox?

We have no way to resolve this paradox other than going to Afghanistan or farther north in search of the so-called Aryan habitats with a copy of the Avestha as we have ruled out the possibility of an Indus or Sarasvati origin to the Vedas. In the words of Kochhar: " We have argued that the river names Sarayu and Sarasvati, that occur in both the Rgveda and Avesta, refer to the rivers in Afghanistan. Sarayu is the same river, Hari-rud, in both cases, whereas the name Sarasvati applied to the Helmand in the Rgveda is transferred to its tributary, the Arghandab, in the Avesta. The district of seven rivers, Sapta Sindhavah, is the same in the two texts and refers to the region occupied by rivers like the Farah-rud..."

These words are typical of the scholarly Indian minds that dominate historical research in India. Discovery of Mohenjodaro and Harappa had perplexed their predecessors who had mocked at claims of Vedic antiquity and the only way out was to bring in a hypothesis of Aryan Invasion. But the discoveries that followed in Rājaputtāṇa and Saurāṣṭra of numerous sites have added discomfiture to this concocted myth in answering many questions and sustenance of this myth depends exclusively on the thwarting of a decipherment of the Indus script and any true historical interpretation of the Vedas, Epics and Purāṇas. Perhaps, there may not be any other modern field of study where so biased minds are working, as to nip any truth that may attempt to come out, in defense of the established notions.

On the other hand Western world has freed itself from the shackles of Christian worldview/ Biblical history in their pursuit of truth and has brought out magnificent works such as Hamlet's Mill (1969), investigating the 'Origins of human knowledge and Its Transmission Through Myth'. Authors of this work were professors of history of science: Giorgio de Santillana [Massachusetts Institute of Technology] and Hertha von Dechend [Wolfgang Goethe University in Frankfurt]. It was long believed by all those who have looked into Indian antiquity that the ancient myths have an astronomical origin but little was done here even after independence to make a concrete study of this aspect as the truths implicit in them threatened the existence of those who have masterminded the concoctions in the name of chronology and history. Three decades before a professor of MIT had the courage to write and publish that the ancient world was familiar with the wobble of the earth's axis through the stars [Precession of the equinoxes] and they found the myths written in the heavens. After a careful study of the myths they have placed the 'earth of the ancient mythical world' in the sky, between the tropic of Cancer and Capricorn and has explained the 'Flood' legends in terms of the fall of a constellational world due to precession. In the Indian context there is nothing new in this discovery – Tilak, Karandikar, and many others shared this belief. But no academician in this country came forward to make a serious examination of the astronomical content of the epics and purāṇas in the post independence period. True interpretations made of the myths as an instrument of record and communication of astronomical phenomena in fact point towards the strength of the oral tradition in preserving chronology and bridging history to prehistory. Nothing may remain as prehistory as for example in India where we find a living tradition extending from time immemorial if we are able to resurrect the hibernating myths in our creative conscience. Indian antiquity and chronology shall then open up in

the sky rather than in some villages carrying the names of Hastinapura and Citrakūṭa. We have done the necessary excavations in the Indus-Sarasvati plains and have failed to locate Hastinapura, Indraprastha and the Citrakūṭa as we have never turned our eyes towards the heavens, even though the fact is quite obvious that Hastinapura is a city beside Ākāśa Gaṅgā. Established notions of history forebids us from looking up and the same trend we have shown in the past in dealing with the Rāśi Cakra. A most unscientific and arbitrary solution was imposed upon the people of India by a committee of eminent scholars and astronomers who ignored the epic, purāṇic and astrological aspects of the problem and today we are forced to carry that legacy forward in terms of a proliferation of sectarian calendars and ayanāṃśas to the utter destruction of the most scientific a way of life. It is against such a background that the true Hindu Zodiac – Mūlādhāra Rāhu Śikhi Cakra – is making its advent. Present chapter is a discussion on the irrational and unscientific comments I have received in the course of my effort to gain scholarly recognition for the discovery. There may be some repetition of the ideas given in previous sections but it is hoped that the ensuing discussion against the negative remarks shall enable those who are not experts to have a better grasp of the controversy of the zodiac and the truth of the solution I have given.

1. Controversial Genesis of Mūlādhāra Zodiac

In this section I have placed together a discussion on the standards of historical research in India and two of my papers on the antiquity of Indian astronomy that have failed to appear in a reputed Journal in the field. As far as I understand the philosophy behind the researches in history of science these papers could not have been rejected over the fictitious grounds communicated through the referee reports. As I have come to know through my interactions with the officials, suitability of the papers is adjudged on the evaluation by two referees – senior academicians – who are having sufficient research experience and exposure to the field of history of science. But unfortunately the referee reports I received were all characterized by poor comprehension of the topic, biased and subjective comments rather than results of objective evaluation/scientific scrutiny etc. There was neither any appreciation nor encouragement for my efforts to refute the Calendar Reform Committee report, which made Citrā the fiducial star of the Hindu zodiac against all norms of scientific objectivity. All referees wanted to cover up the shortcomings of the CRC report and the first of my papers 'True Rationale of Sūryasiddhānta' could appear in a journal only after confrontation with many referees who were avowed champions of the Citrapakṣa Zodiac. Fortunately the associate editor of the Journal was kind enough to entertain my conflicting views on the referee reports and the matter was finally placed before the octogenarian scholar Dr. K.V.Śarma in 1996. On his approval the astronomical rationale underlying the Tāntric concept of Mūlādhāraṃ and Kuṇḍalini appeared in print for the first time in IJHS, Volume: 32 (3), 1997. The criticism here is only of the unscientific reasons quoted and not of the decision to reject any paper because of the shortcomings in the preparation.

• On the fiducial role of Mūla and the zero point of Siddhāntic astronomy the comments received were:

"If we assume that both the tropical and sidereal longitudes of Mūla were 240^0 at the epoch of Sūryasiddhānta then that epoch comes out to be 238 AD or 3340 Kali. This

epoch is only 47 years away from the epoch of 285 AD suggested by M.N.Saha and N.C.Lahiri. The detailed analysis by Saha and Lahiri has shown that the epoch of Sūryasiddhānta could have been any of the three years 340 AD, 500 AD and 560 AD. K.D. Abhyankar (IJHS 26 (1), 1991) has shown that the least square solution gives an epoch of 430 AD. However, actually the controversy about the zero point is pointless, because what we need now is the use of one agreed zero point by all the astronomers. And the epoch of 285 AD for that purpose suggested by the Calendar Reform Committee suits this requirement quite admirably. In view of the above comments it is concluded that the paper is not suitable for publication in IJHS in the present form".

My paper did clearly demonstrate the eastward regression of the Siddhāntic zero point and the un-tenability of Saha's conjectures on the three Siddhāntic zero points vis-à-vis the order of the epochs AD 285, AD 499 and AD 576. But the referees who evaluated the papers simply went on parroting the CRC report rather than trying to understand my arguments. We have already discussed this aspect in the section on Siddhāntic astronomy. Siddhantic zero or the mean sun corresponding to the expiry of the Kali year coincided with vernal equinox in AD 499. Due to the surplus in the siddhāntic solar year the zero had an eastward regression relative to vernal equinox since AD 499. Vernal equinox of AD 285 east of the zero while the vernal equinox on Revatī (AD 576) was west of the AD 499 zero point. Under these circumstances how can the Siddhāntic zero advancing towards east coincide with a point lying on the west in AD 576? Due to the same reason it was impossible for the Siddhāntic zero to fall opposite Citrā in AD 285, which actually happened around AD 1875.

• Without caring to look for the computational implications of an extra-long sidereal year another referees wrote:

"*The author has attempted to trace the zero point of the Hindu zodiac based on the following principles: (a)...(b)...(c) The position of zero point of Hindu zodiac is the mean sun at the end of each Kali year i.e., the zero point has an eastward motion. (d) The zodiac was divided into 108 equal parts each 3°20' to identify the equinoxes and solstices. (e) Because of (c) above, the zero point coincided with vernal equinox in 3623 Kali years i.e. 23 March 230 AD (may be typographical error/over sight: 3623 Kali years = 522 AD). (f) The zero point coincided with Revati in 3275 Kali... → (c) Demands that the zero point should have an eastward motion. In that case, the zodiac no longer remains a sidereal one and hence this principle violates the very basic idea of a sidereal zodiac. The number of revolutions in a Yuga of the various planets does not fit into such a zodiac. → There is no evidence in any astronomical or Purāṇic or mythological literature that the zodiac was divided into 108 parts. → (e) and (f) are arithmetically correct, but a moving zero point is totally opposed to a sidereal zodiac. → The idea of the author is new, but it violates all principles of Siddhāntic astronomy.→ Saha and Saha only, has given a logical and scientific account of the Hindu zero point consistent with the basic principles of Hindu astronomy*".

The remarks (shown as →) of the referee are absurd and arose out of his ignorance of Siddhāntic astronomy. Author did not propose an eastward advance of the Siddhāntic zero – it was a fact arising out of the computational frame of the Siddhāntas. Moreover

the author was not the first person to take note of it. As I have come to know later T.S.K.Śāstry and K.V.Śarma had made a mention of this 'violation of sidereal zodiac' in their work on Vākyakaraṇa decades before. Referee's opinion that (e) and (f) are arithmetically correct in fact amounted to agreeing with author's surmises about the Siddhāntic zero point. So despite the computational evidence to the contrary referee chose to eulogize Sāha's account and the paper was returned with no clear suggestions as to what modifications are required to make it suitable for publication.

Also note the stout denial: *"There is no evidence in any astronomical or Purāṇic or mythological literature that the zodiac was divided into 108 parts".* In fact there were many references that pointed towards such a division of the ecliptic and a few such references we have already seen. I shall briefly enumerate them for an easy reference:

• Astrological literature begins with a description of the zodiac having 108 divisions

"Meṣāśviprsthamā navarkṣacaraṇā cakrasthitā rāśayōḥ"
(Varāhamihira's opening verse of Bṛhajjātaka)

• Mahābhārata, Āraṇyakaparva III.18-28, enumerates the 108 names of the sun god.
• Description of the Rāśicakras available in Maitrāyaṇa Upaniṣads, Viṣṇupurāṇa etc., all suggests a division of the ecliptic belt into 108 navaṃśas.
• Aṣṭōttaraśata nāmāvalis have been famous in India since the time of Mahābhārata at least.

What we see above is not an evaluation of the contents of the paper but a sermon from the referee in favor of the Citrapakṣa to discourage the author from pursuing the thesis further. It is my experience that none ever gave any suggestion or guidance to give a strong foundation for the Mūlādhāra Cakra.

2. On 'Prehistoric Indian Astronomy'

The paper 'Prehistoric Indian Astronomy' was prepared in 1999*. The scholarly comments received, as referee report was a commentary with the following notable paragraphs:

• Paragraph (1) was a brief by the referee on the astronomical features of the epoch 4137 BC.

• Paragraph (2)

"According to the author 4137 BC was the epoch of forming the Hindu sidereal zodiac called Mūlādhāra Cakra or Rāśi Cakra with λ -Scorpii (Mūla) as the fiducial point with a longitude of 240^0 because this point of the human body also forms the Mūlādhāra of the Mūlādhāracakra of the human body according to the Tāntric School. He has quoted several purāṇic legends in support of his thesis so as to identify: (i) the autumnal equinox

* I have incorporated the contents of the paper in the section on Tāntric Astronomy.

at Dhanu rāśi with Mahākāla Śiva (ii) the winter solstice at Mīnā rāśi with amṛtakuṃbha of the samudramanthan carried away by the Asuras, and (iii) the summer solstice at Kanyā rāśi as the birth of Hari-Hara-Putra as well as Durgā. Here it may be mentioned that Durgāṣṭamī occurs in the bright half of every lunar month and not in Bhādrapada only. One can put forward alternate explanations of these and many other Purāṇic legends by identifying Orion (Mṛga) with Mahākāla Śiva as well as with Prajāpati and Trimūrtti Dattātreyā. But the following technical objections are more relevant to the author's hypothesis."

• **Technical objections**

(i) "*The ancient epochs of Maitrāyaṇi saṃhitā (1900 BC) and Vedāṅga Jyotiṣa (1450 BC) use winter solstice as the time of starting the year while the Siddhāntic and Yajurvedic astronomers put the starting point of Nakṣatras at vernal equinox. It is also likely that some ancient astronomers used autumnal equinox as the starting time of the year. In that case λ-Scorpii should have a longitude of 270^0 or 180^0 or 0^0, but not 240^0. Actually in those ancient times astronomers did not use degrees to measure angles; however counting of days might be prevalent. But if one insists on giving λ-Scorpii a longitude of 240, then one has to go back to the earlier epoch of 6000 BC when Caitri full moon marked the beginning of Uttarāyana. And in that case λ-Scorpii position of the sun will indicate the beginning of Śarad ṛtu and not autumnal equinox.*

That λ-Scorpii has a longitude of 240^0 in the Babylonian system is indicative of the fact that their stellar (nirayana) Aries started from a point about 7^0 west of the vernal equinox of 300 BC, which can be confirmed from the boundary of Aries in the Norton star atlas. The concept of signs (sāyana rāśis) was introduced by the Babylonians in their calculations for covenience. But we adopted their nirayana rāśis and fitted them into our system of nakṣatras, because they agreed with the vernal equinox of the Siddhāntic period".

(ii) "*The author has talked about a Sura-gaṇana (tropical lunar) and an Asura-gaṇana (sidereal solar) without explaining what they actually mean. Particularly it is not clear why the sun should be associated with the sidereal and moon with the tropical calendar. What we have for a very long time is the luni-solar calendar, which takes into account the positions of both the sun and the moon. Actually a useful calendar has to be Ṛtu-saṃvatsara i.e., tropical in nature. But there is a very small difference in the lengths of the tropical and sidereal years. So a sidereal calendar based on a particular fiduciary nakṣatra can serve the purpose for about 1000 years. But one has to change the fiduciary nakṣatra by one step after about 1000 years. It is evident that this was the method followed by our ancient Ṛṣis, because due to ayanacalana they changed the year beginning at winter solstice from Caitri full moon to Phālgunī full moon and then to Māghi full moon and still later to Māgha S (1). Similarly, they changed the enumeration of the nakṣatras from Kṛttikā as first nakṣatra to Aśvini as the first nakṣatra when the vernal equinox shifted backwards due to precession*".

(iii) "*According to Section V of the paper the Siddhāntic constants of 500 AD correspond to those of 4000 BC. Does it mean that there was no progress in the astronomical*

knowledge during the long period of 4500 years? Also the Rāhu-Śikhi Cakra can come back to the same point of the ecliptic after 18.6 years, so it is of no use for fixing an ancient epoch. It is apparent that the author has stretched his attachment for the Tāntric School to astronomy by ingenious speculations about the Purāṇic legends to fit with his assumed fiduciual longitude of 240^0 for λ-Scorpii. But the word Mūla comes from the root like appearance for the Mūla nakṣatra represented by the sting of Scorpio. It does not mean origin, because then it would have a longitude of 0^0. We have already pointed out that the legends can also be interpreted differently'.

• **Following reply was given seeking a review of the rejection of the paper:**

"Referee's comments as I understand, seek certain clarifications on specific points about which the referee could not comprehend the author's view point rather than suggesting any modifications. As such I'm submitting the following explanations so that the referee may review the negative recommendations if any as regards the publication of the article under reference in your journal.

• The first paragraph of the referee's report does not contain any criticism of my paper. But he has observed that – "This epoch is close to the Ṛgvedic period of 4000 BC found by B. G. Tilak on the basis of the vernal equinox in Mṛgaśīrṣa nakṣatra and by P. C. Sengupta on the basis of the heliacal rising of Aśvini at the beginning of the Vasanta ṛtu". It must be noted here that my work in fact provides the true rationale to the epoch of 4137 BC rather than those of either B. G. Tilak or P. C. Sengupta. I have given a clear refutation of Tilak's thesis on 'Orion' in which he credited Kṛṣṇa with a misconception. Please see pages (7) and (8) of my paper. As far as P.C. Sengupta's view is concerned, I'm at a loss to understand as to how can we accept such a view for the epoch of 4000 BC. Is there a specific beginning for Vasanta ṛtu other than vernal equinox? At vernal equinox in 4137 BC the acronycal rising of 'Mṛga' was a better observation than the heliacal rising of Aśvini and that is why Mṛga received the name 'Āgrahāyaṇa' – as it heralded the beginning of the New Year with Mārgaśīrṣa. In the light of this particular aspect I have mentioned on Pages 7 & 8, P.C. Sengupta's theory loses its significance.

• The major argument of the referee appears at the end of paragraph (2) as: "*One can put forward alternate explanations of these and many other purāṇic legends by identifying Orion (Mṛga) with Mahākāla Śiva as well as with Prajāpati and Trimūrthy Dattātreyā.*"

I'm sorry to state that the referee is absolutely wrong in making this statement, because of the following reasons:

(a) I have identified Rudra-Śiva or Mahākāla as Mūla (λ-Scorpii) in view of Mūla being the fiduciary star that marked the Mūlādhāraṃ of Kālapuruṣa in symbolic equivalence with the bottom of the cerebro-spinal axis of Jīvapuruṣa. With the same reason I have also explained the worship of Rudra-Śiva as Phallus. Bottom of the cerebro-spinal axis as per the astrological theory falls at 240^0 of the zodiac. Under these circumstances how can Orion be identified as Rudra or Mahākāla? Anyway, if it is possible, let others do it and let my views get refuted – that I think is the path of research and evolution of right perceptions. It is after more than a century that I have now come up with a refutation of Tilak's hypothesis/alternate explanation to the epoch of 4100 BC.

(b) Referee has overlooked many crucial aspects of my paper while coining the above lines. I have explained Rudra's identification with Mūla and the Tāntric significance of this identification in the paper "On the Origin of Sidereal Zodiac and Astronomy" that appeared in the IJHS, December 1998 issue. I do agree that the work contains speculations. In fact speculation cannot be avoided in a work of this sort. The test of a valid hypothesis must be convergence of logic when we take a wholesome view of the paper.

• **Reply to Technical Objections**

(i) The first technical objection raised by the referee is that with "Mūla autumnal equinox" as the year-beginning λ-Scorpii should have a longitude of 270^0, 180^0 or 0^0 but not 240^0. This observation is not correct. Mūla was the sidereal beginning of the year and in 4137 BC autumnal equinox fell over it. Sidereally, by virtue of Mūla's fiducial role it always had a fixed longitude of 240^0 in the Tāntric Zodiac. As for example: In Kollaṃ Era, the year begins with the solar transit into Siṃha (Leo) rāśi in South Kerala while Northern Kerala has the tradition of year-beginning with Kanyā rāśi i.e., based on the fixed zodiacal signs. But nobody consider the beginning of Siṃha/Kanyā rāśi as the zero longitude of the zodiac. Any such conception is contradictory to Mūla's fiducial longitude of 240^0 that makes Mūla i.e., Rudra the Mahākāla i.e., the crux of Kālacakra or time. This so-called technical objection is another illustration of the fact that the referee has not understood the subject matter of my paper.

In the second paragraph referee says that the concept of signs was introduced to India by Babylonians. He is quoting an established notion devoid of any supporting evidence. I have already shown in my paper published in the IJHS, December 1998 issue that Babylonian's derived the rationale of the initial point of their fixed zodiac from the Indian Tāntric tradition of Mūlādhāra Cakra. As regards the place of origin of rāśis only speculations exist and if any scholar feels that Chandra Hari is wrong let him refute my hypothesis by a separate paper. In the context of Babylonian versus Indian astronomy, I have given another paper also to IJHS. Perhaps it may clarify some of the doubts.

(ii) Second of the technical objection is:

"*The author has talked about a Sura-gaṇana (tropical-lunar) and an Asura-gaṇana (sidereal solar) without explaining what they actually mean*".

I'm surprised to note this comment. Please see page 11, second paragraph (i.e., lines 18-24) where I have illustrated the concepts by giving examples for the "tropical-lunar" as well as "sidereal - solar" calendars. Towards the end the Referee says: "So a sidereal calendar based on a particular fiduciary naksatra can serve the purpose for about 1000 years. But one has to change the fiduciary nakṣatra by one step after about 1000 years"

Referee has not understood the concept of a sidereal Calendar/Zodiac/or the concept of a fiducial star. Fiducial star is the eternal reference of the sidereal Zodiac. For example: with the Mūlādhāra Cakra, Mūla shall be of the fixed longitude 240^0 eternally irrespective of the cardinal points. The so-called change from Kṛttikā to Aśvini as the first nakṣatra in

the enumeration is not at all sidereal. They are tropical conceptions of the Vedic tradition. In the Tāntric tradition Aśvini was the first nakṣatra division always and this prehistoric conception lies at the root of the Babylonian /Siddhāntic Zodiac. Due to historical reasons many of the true rationales are not apparent today but by creative efforts such extinct features can be brought forth. In the light of such new ideas we will be able to comprehend the present day features in a better background of their origin. It was not by accident or error that the siddhāntic zodiac took a sidereal shape (even though the established notions speaks so). Siddhāntic astronomy had to bear with the social compulsion arising out of the Tāntric tradition and hence the "humbug" (admixture of tropical & sidereal concepts) zodiac took shape in Siddhāntic astronomy of Āryabhaṭa, Bhāskara I, Brahmagupta etc. It must also be noted here that the Hindu religion/way of life extant today having the dominant influence of Idol worship is not Vedic in character – not only Śiva and Śakti but all the Idols are of Tāntric origin and in the temples the Vedic deities like Indra have their seats only outside the sanctum sanctorum. In a similar amalgamation, the cardinal points and the tropical zodiac lost their significance (like Indra) to the Tāntric fixed zodiac. Unfortunately in this process, which took place at distant antiquity, the true rationale of the fixed zodiac was lost and a lot of confusion arose in due course of time.

(iii) As far as the third objection is concerned, referee asks: "Does it mean that there was no progress in the astronomical knowledge during the long period of 4500 years?"

It is a matter of drawing the inferences, which may differ from person to person. A better inference is that some dark age separated the Tāntric phase of our civilization from the Siddhāntic astronomy phase. No concrete conclusions are available even about the disintegration of the Indus Valley civilization, which many scholars have considered as Tāntric in character. Even much before Aryabhata, Indians knew the theory of earth's revolution but in the centuries that followed this discovery, no further development took place. Similarly, from Ptolemy to Kepler there are 1500 years – Can we say that 1500 years was necessary for the above progress? – And From Kepler to "Man's landing over the moon" there are only 500 years – what inferences can we draw about the pace of our progress?

Rāhu-Śikhi Cakra: Referee has taken the concept in isolation to reduce its significance. It is true that the nodes repeat in 18.6 years, but in 18.6 years new moon do not coincide with Mūla and the autumnal equinox. It is therefore obvious that the Iconography of Rudra-Śiva would not have received a complete explanation with any other epoch.

• Last Paragraph:

What attachment can I have with the Tāntric School? Further Referee says: "But the word mūla comes from the root-like appearance of the Mūla nakṣatra represented by the sting of Scorpio..."

"...root-like appearance" is this not speculation? Mūla means not only root, it means also the bottom (root?) of the cerebro-spinal axis of Man..."

To conclude, Sir as the referee says, if my work is speculation alone – even then those

speculations are better than the prevailing ones. It is apparent from the 'comments' that the referee has not evaluated / unable to evaluate the paper properly. According to the referee around 4000 BC the astronomers did not use degrees – they only counted the days. If this is accepted, then all that I wrote is absurd imagination. Please contrast the referee's comments with the papers published in IJHS on the 'Yantra Sarvasvaṃ' / 'Amśubōdhini' of Ṛṣi Bharadvāja: Can anybody produce even an iota of evidence to establish the existence of spectrometer and wave lengths of Fraunhoffer lines in the distant antiquity of Bharadvāja? Can a spectrometer be possible when the angles had no proper measurement and units? Is there any historical evidence at all to justify the existence of an electrical apparatus using the conical prism for the study of solar/stellar spectrum in ancient India?

Sir, Indian antiquity remains almost un-explored and as such if we evaluate the emerging creative works with the established notions, we will be committing a grave error. In fact, if the referee's observations are accepted as correct we can't attach any value to either the aforesaid paper on the Bharadvājas spectrometer or to B.G.Tilak's century old "speculations". So my humble request is that in the light of the clarifications given, the paper may please be considered for publication. If it stands rejected in view of the referee's comments the same may please be communicated.

Editor chose not to give any cognizance to the counter filed by me against the referee report and the paper failed to appear in the journal. Editor of the Astrological Magazine was kind enough to take it up for publication and the paper appeared in three parts beginning with the 2000 annual issue of the Astrological Magazine.

3. 'Search for an Ancient Epoch of Indian Astronomy'

Subsequent to the above rejection a paper that briefly expressed the astronomical features of the epoch of 4137 was submitted in the middle of July 1999. Referee approved the paper for publication but desired that:

"The following questions are likely to occur to readers of the paper and so the author will perhaps do well if he gives his views on these in an appendix or in the body of the paper.

1.Source materials at hands of Tilak and Jacobi were Vedic or religious literature, many parts of which are obscure in meaning. Any scholar may twist them to meet their needs. But historical and archaeological evidences firmly fix the epoch of Vedic literature between 2500 to 2000 BC.
2.There is nothing in the Vedāṅga Jyotiṣa, which even remotely refers to a 19-Year cycle. The text has repeatedly stated in several places that a Yuga contains 5 years. It is too tall a claim that V.J used a 19-Year cycle.

The academic value of the paper will be further enhanced if the author gives his views on these two points".

To meet these suggestions an appendix was submitted in two parts but that did not qualify to appear along with the paper published. Contents of the paper and Part II of

appendix, which contained the clarifications on the 19-Year cycle of Vedāṅga Jyotiṣa, I have already discussed in the section on Tāntric astronomy. Part I having a few observations relevant to the context of research in history of science is reproduced below:

Part I: Interpretation of Vedic or religious literature and the antiquity of Vedic civilization.

- **Interpretation of the obscure verses**

Present author fully agrees with the referee that many of the Vedic terms/passages have got obscure meanings and some scholars may willfully manipulate the situation by ascribing specific meanings that suit their purpose. But as far as Tilak and Jacobi are concerned we must consider them as exceptions who have worked most sincerely to understand the Vedic literature with a creative mind founded on vast and incomparable scholarship. The astronomical interpretation of Vedic hymns certainly involves some risk but we have no other recourse to understand as well as ascertain the real merit. As for example, the astronomical data I have provided in the present paper is corroborative of the astronomical meaning Jacobi has ascribed to the respective hymns. Also it suggests that the year-beginning with vernal equinox as suggested by Tilak was wrong and Mṛgaśīrṣa received the appellation Āgrahāyaṇa owing to its acronycal rising rather than due to the fall of vernal equinox and year beginning. It is therefore apparent that we can consider the astronomical interpretations of hymns as only tentative till we are able to ascertain their truth by proper astronomical data.

We must all guard against the general notion that illiterate nomadic tribes founded the Vedic civilization. How can we explain the origin of a unique scientific language in such distant antiquity? What must have been the age of the civilization that produced such a wonderful language and method of preservation of the Vedic literature?

We can see the astronomical development in all primitive civilizations such as the Maya, Sumerian, Chinese etc., Had the process of evolution of a scientific language been a natural process like the astronomical observations, why are we unable to find anything comparable to Sanskrit and the Vedas elsewhere in the world?

Let me quote another specific example that demands a change in our perceptions on the state of scientific development in the Vedic civilization. IJHS 29 (4) and 33 (3) contained papers on the manuscript of 'Amśu Bōdhini' supposedly written by Ṛṣi Bharadvāja in some prehistoric times. How could anybody think of a study of solar spectrum with a conical prism before the advent of modern science? How can astrophysics develop before the development of astronomy? Can we say that the above manuscript and the meaning ascribed to it are all bogus / designed for a sinister interpretation? In fact endless questions emerge from such a manuscript but our historians of science chose to ignore it and there was no discussion in the columns of IJHS with reference to the two papers that appeared. It is better late than never and so I shall request the editor to invite the attention of the historians of science to those papers again through a special editorial note.

Antiquity of Vedic Civilization

Referee has rightly pointed out that the 'historical and archaeological evidences firmly fix the epoch of Vedic literature between 2500 to 2000 BC'. But the present author is doubtful as regards the "completeness" of the historical and archaeological evidences available to us today. Let me point out a few important aspects in this regard:

(i) Historical and archaeological evidence is not at all complete for the simple reason that the Indus Script remains un-deciphered.

(ii) Archaeological evidence can never claim "completeness" as new and deeper excavations are bringing to light new aspects of the civilizational history of humans every day. Just the day before (18/09/99) only I saw in the Discovery Channel that a new skull discovered in Indonesia may compel the scientists to rewrite the story of human evolution! I think we can't foresee an end to this rewriting process!

As for example till recent times, we had no idea about the Ebla site of northwestern Syria. But archaeological excavations of the recent past led to the discovery of 15,000 clay tablets (4500 years old) – the largest archive of third-millennium texts ever found. Can we conclude that the present archaeological conclusions are going to be final? Even about Mohenjo-daro and Harappa are we sure that we have already reached the bottom-most layer of the ruins? Are we sure that there are no other such sites in other parts of the Indian subcontinent?

The epoch of Vedic literature have been fixed firmly at 2000-2500 BC, as I understand on the strength of the 'Kṛttikā equinox' referred to in the Brāhmaṇas. Some historians like Debiprasad Chattopadhyaya (Ref: History of Science and Technology in Ancient India, Pub: Firma KLM, Calcutta) has disputed even such inferences and has credited the astronomical observations alluded in Vedic literature to the so-called Dravidians of the Indus valley. On accepting the above mentioned firm limits of 2000-2500 BC, I fail to comprehend as to – how can a human settlement reach such civilizational heights as to create a wonderful language like Sanskrit and phenomenal amount of literature in just 500 years? Can't we be sure that while coining the Gāyatri mantra (with the loftiest of the human aspirations for enlightenment) Viśvāmitra must have a civilizational history behind him and a fully developed language at his hand?

Due to paucity of space, I would like to cut short the discussion with the conclusion that the prevailing notions are based on incomplete knowledge and a limited canvas of thinking and they do not stand the test of reason over a broader canvas of creative examination of all relevant details.

• Now in August 2001, at the time of final editing of these pages I have come across the details of the discovery of Chauvet Caves in France which contain drawings 35000 years old as against the 20000-year-old images at Lascaux or 17000 –year –old paintings in Altamira (Spain). Antiquity established of these wonderful cave drawings runs counter to the scholarly notion that art and cultural evolution had advanced in the same fashion as biological evolution – art accordingly begins with primitive scratchings and progresses to 'lively naturalistic renderings'. To quote from National Geographic August 2001, Vol.2: "Surely the subtle shading, ingenious use of perspective and elegant lines of Chauvet's masterworks placed them at the pinnacle of that progression. Then carbon dates came in, and prehistorians reeled. Approximately twice as old as those in the more famous caves, Chauvet's images represented not the culmination of prehistoric art but its earliest known beginnings. A few thousand years after anatomically modern humans appeared in Europe, cave paintings was as sophisticated as it would ever be".

I hope these words shall serve as an eye-opener to those who describe the Indian antiquity as 'primitive'. Cultural advancement, advances in art and poetry cannot find a better illustration than in the Vedas, Epics and Purāṇas.

4. 'Sidereal zero point – A Mathematical Solution'

Paper contained an astronomical cum mathematical argument based on the Siddhāntic assumption of zero mean λs at $\mathbf{K}_0$ and the fixed aphelion. It is simple for anyone to understand that according to Sūryasiddhānta the solar aphelion and zero point are fixed and this inturn meant that the zero point had a fixed anomaly. As such the vernal equinox coincided the Hindu zero point when it assumed the fixed anomaly of the zero point and the epoch turns out to be around AD 238. The referee failed to understand or did not pay any attention to the contents and rejected it on extraneous considerations. Fortunately, the associate editor allowed my appeal and the paper was published.

5. 'Ancient Indian versus Babylonian Astronomy'

Paper was initially submitted under the title 'Babylonian versus Indian Astronomy' and underwent refereeing thrice but ultimately it was rejected. In the first report, referee had stated: "The author in this paper presents an interesting perspective which is worth considering for publication. However, some improvements and clarifications are required. Final submission was made with the following prefaces, which are self-explanatory:

Thank you for the above communications and the paper revised as per the suggestions of the referee is enclosed here with. Also as per the instruction of the referee, I have given a listing of the changes incorporated separately.

Except for the two comments related to P.V. Holay and Dr. S.R. Rao's work, I have most sincerely tried to ensure a **cent percent compliance**. As far as Holay's work and its implications/ recognitions are concerned my comments in detail will be appearing with the paper "Search for an Ancient Epoch of Indian Astronomy", vide its appendix. Referee has suggested Dr. S.R. Rao's work, to establish the Vedic nature of the Indus civilization. As I understand Rao's work is going to face an anticlimax in the light of Jha's decipherment and so I have not referred to Rao's work in this paper. I have explained my position in the attached listing of changes. In the Āryabhṭīyaṃ 2000 conference at Trivandrum, when the query came as to whether the Indus civilization was Vedic or not, it was the octogenarian scholar Dr. K.V. Sarma who stood up quoting Jha's works to declare that the Indus civilization is Vedic. So we can't say that Jha's work is not having sufficient recognition in academic circles. On the contrary, if I quote S.R. Rao as suggested by the referee, of course my paper will have a very popular authority cited, but an authority of no substance whose work will speak more of pitfalls in historical research...!

In fact the above question of Vedic or non-Vedic has not much relevance to my work on astronomy. The astronomical evidences alone are sufficient to justify the publication of my paper. In fact, a study in contrast of the present paper with those of IJHS, Vol. 20 (the complete volume dedicated to the History of Astronomy in India) may throw enough light on the significance of the propositions I have made in the present paper. I have never been hesitant to clarify the academic issues involved - say for example - if anyone

disputes the astronomical facts I have presented I am ready to rewrite the paper a hundred times. My plight has been always to struggle with secondary factors like the above ones...

Kindly make an effort to see the wholesome merit of the work as against some defects that may remain. I have complied with all the referee suggestions except for the explanation provided and have made a serious attempt to improve the presentation also....

Modifications made as per the referee reports 1 & 2

I have made a sincere effort to rectify the drawbacks pointed out by the referee as per the details submitted below:

Part- I: With reference to Report 2,

(i) An effort has been made to improve the presentation by thoroughly revising the introduction. I have placed my thesis against the backdrop of the relevant studies of the past.

(ii) Full bibliographic references of the works of Siedenberg and N.Jha have been provided at the relevant page (10) as footnotes.

(iii) All typographic errors have been corrected.

(iv) Paragraph (4) of report (2): distinction between Tāntric and Vedic tradition. I have only tried to give the accounts of some important authors so that the readers of my paper are able to understand the historical position of Śiva and the Tāntric cults. Pl. see pages 11 & 12 and the quoted opinion of Manoranjan Basu. Chronologically no difference is possible and I think the Vedic and Tantric cults had a simultaneous existence probably in different locations. This is some thing that needs further research to reach a conclusion.

(v) Where ever the dates are given sufficient justification and the references have been provided.

Part II: Modifications made as per Report 1.

(i) Already mentioned above. Bibilography and other details relevant to the context have been provided as footnote at page 10.

(ii) Indian Tāntric zodiac and chronology: Complete details given (p.15-20)

(iii) Both the suggestions have been accounted at p.10 and p.26 respectively.

(iv) Sufficient explanation provided at page 26/27 as footnote.

(v) Rectified at page 30, third paragraph.

(vi) Reference provided at page 30, 5th paragraph where the statement occurs.

(vii) Explained as footnote at page 33.

(viii) Basis of 4137BC sufficient explanation provided at page 15-17.

(ix) Revised the part and added further information at page 39,40 and 41.

(x) I have explained my views on Holay's work at page 2. Prevailing notions are wrong not only about Vedāñga Jyotiṣa but also about Sūryasiddhānta, sidereal zodiac etc. Holay's work leaves no room for any doubt. It is only because of its 'consequences' that it has not received wide popularity. Moreover Holay is not an academician having sufficient contacts. Similar is the situation of Natvar Jha. Sir, my humble opinion is that 'universal or general acceptance is not a valid criterion to assess the academic merit of a research work. Universal or general acceptance may come only after decades. Even Einstein's relativity theory had fierce opponents and the theory got recognition only after Eddington verified the deflection of starlight by Sun. But researchers did not wait for the universal acceptance of Einstein's theory to carry the work forward.

(xi) Now coming to the work you have suggested i.e. of Dr.S.R.Rao: According to Rao, the people of Indus civilization had a pre-Vedic Indo-European language and later on they have composed the Ṛgveda. I have no appreciation for such a view. Further, as I have come to understand, the decipherment he has made of the script is also wrong. Sir, I hope you won't insist any modification on the above point.

(xii) All corrections have been made. Use of the notation (–) 311AD, (-) 345 AD etc., can be found in papers published in IJHS itself. It means say (–) 311 AD is 312 BC and (-) 345 AD =346 BC or BCE, people use differently.

(xiii) References have been rationalized. All have been checked and corrected and is in the right format.
I hope these modifications will be satisfactory".

The extracts of the paper relevant to the comparison between the Indian and Babylonian astronomy are reproduced below:

• **Ancient Indian versus Babylonian Astronomy**

Introduction

The location as well as epoch at which astronomy had its beginning and the civilization that brought into existence the zodiac has remained a topic of hot deliberations ever since the European scholars have laid the foundations of historical research in science. In the 18th century J.S.Bailly[1] (1736-1793) had expressed the view that astronomy had its origin in India and was later on transmitted to the Chaldeans and the Greeks. Samuel Davis[2] and Bailly did accept the value of 24^0 for the obliquity of the ecliptic as observational and accordingly arrived at two dates viz., 2050 BC and 4300 BC respectively, for the determination of the above value. In 1790, Williams Jones tried to show that the division of the ecliptic into 12 divisions and the associated symbols are of Indian origin. According to S.N. Sen:[3]

"...thus started a great controversy on the antiquity of the zodiac and the priority of its invention which razed throughout the 19th century involving some of the best orientalists and historians of astronomy of the time."

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[1] S.N.Sen, Survey of Studies in European Languages, IJHS, 1985, Vol.**20**, p.51
[2] Davis, Samuel. On the Astronomical Computation of the Hindus, Asiatick Researches, **2**, pp. 225-287, 1790
[3] S.N.Sen, Survey of Studies in European Languages, IJHS, 1985, Vol.**20**, p.54

In the beginning of the 19th century, H.T. Colebrook arrived on the scene with his great work, 'On the Indian and Arabian division of the Zodiac' (1807 AD) that credited the Indians with the division of the ecliptic into 27 parts and suspected a Greek hint behind the Indian incorporation of the 12 signs of the zodiac[4]. C.M. Whish[5] went further than Colebrook and attempted to establish a Greek origin by a comparison of the astrological and astronomical terminology of Varahamihira with that of the Greeks. With Weber, Burgess, Whitney and Thibbaut the hypothesis of Greek origin achieved further nourishment, a reflection of which can be found in the words of Thibbaut:[6]

"Surely, we have a right to say that the system, in its from as laid before us must come from another people or another generation than that which laid its scientific foundation; that it must be the work of a race which either had never known or had time to forget, the observing habits and the inductive methods of those who gave it origin... The preceding remarks merely aim at showing that there is no evidence for the earliest Siddhāntas having identified the place of the vernal equinox with that of Piscium, and that we hence are not compelled to look for the beginnings of scientific Hindu astronomy in a period not earlier than the fifth century."

Other highlights of the historical researches related to Indian astronomy include the Biot's thesis on the Chinese origin of Indian nakṣatras[7] and the Weber's counter-thesis[8], various opinions on the antiquity of Vedāṅga Jyotiṣa[9], 'Bhāratīya Jyotiḥśāstra' by S.B.Dikshit[10], Prof. P.C.Sengupta's 'Ancient Indian Chronology'[11] and finally we have got the Calendar Reform Committee report[12] in 1955 where-in we can find a search for the definition of the Indian zodiac under the Chairmanship of Dr.M.N.Saha. In view of their relevance in the ensuing discussion we shall have a closer look at the Vedāṅga Jyotiṣa and the CRC report by Dr.M.N.Saha & N.C. Lahiri.

- **Vedāṅga Jyotiṣa**

Studies on Vedāṅga Jyotiṣa began with the works of Weber in 1862 and Thibaut in 1877 and since then a number of studies have appeared based on a string of emendations to the Ṛg as well as Yajur recensions which together has come to be known as Vedāṅga Jyotiṣa. Somakara whose date is not known was a classical commentator of the Yajur Jyotiṣa and his interpretation - the only light available on to this ancient treatise - in itself is only partial. According to S.B.Dikshit, Thibbaut could explain the meaning of 6 verses more than that of Somakara's commentary and he himself relying on all past attempts by

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[4] Colebrooke, H.T. On the Indian Arabian division of the Zodiac, Asiatick Researches, **9**, pp.323-376, 1807.
[5] Whish, C.M. Quoted at reference (3) above at page 64.
[6] Thibbaut, G. In his introduction to the English translation of Pañcasiddhāntikā.
[7] Biot, J.B. Quoted at reference (3) above at page 67.
[8] Weber, A. Quoted at reference (3) above at page 67.
[9] S.N.Sen, Survey of Studies in European Languages, *Indian Journal of History of Science*, 1985, Vol.**20**, pp.74-75
[10] S.B.Dikshit. *Bhāratīya Jyotiḥśāstra* Vols. 1&2, Controller of Publications, N.Delhi
[11] Sengupta, P.C. *Ancient Indian Chronology*, University of Calcutta, 1947
[12] Saha, M.N. and N.C.Lahiri. *History of the Calendar*, CSIR, New Delhi (1992).

various authors could explain only the 36 out of 49 verses.[13] Other illustrious commentators include Pt.Sudhakara Dvivedi, R.Shyama Sastry and T.S.Kuppanna Sastry who has suggested 39 emendations for the 36 verses of the Ṛg recension. The interpretation of Vedanga Jyotisa had a revolutionary turn with a creative leap by P.V.Holay[14], who has interpreted the original text (devoid of the various amendments suggested to achieve decipherment in recent times) as implying a Yuga or luni-solar cycle of 19 years. The fact that it has not received universal acclamation within a decade or so of its advent must in no way affect its acceptance as a valid scientific treatise in the area of historical research. As the author has pointed out in his preface, Dr.K.D.Abhayankar of Usmania University and Dr.S.D.Sarma of the Patiala University – two well known figures in the field of astronomy – have been associated with him in working out certain mathematical implications and as such the epoch making work should have received more attention of the intelligentsia of history of science. If it has not received the attention it deserves, the fault lies more in us rather than in the work of Holay. The use of Holay's propositions in research must therefore be evaluated entirely on its academic merits.

- **Calendar Reform Committee Report**

CRC report presents us with the latest (1955) conclusions on the history of astronomy in general as well as in the Indian context. As regards astronomy and astrology the committee observes:[15]

"From very early times and amongst widely separated communities, mystical importance was ascribed to the wandering of the planets. These mystical ideas took a very definite form in the shape of 'Planetary Astrology', which grew in Mesopotamia during the period 1300 B.C. to 800 B.C. This Planetary Astrology is to be distinguished from an older form of Astrology widely found in Vedic India, which centered mainly round the moon, and the lunar mansions, and to a lesser extent on the sun.... Planetary Astrology took the world by the storm after 300 B.C...."

Dr.Saha's caricature of astronomical developments continues further and joins Alberuni in condemning astrology in the following words:[16]

"The "astronomical science" as evolved by the Chaldean astronomers, is seen to be in reality the byproduct of the huge amount of astrological nonsense, a few pearls in a huge mass of dung, as Alberuni observed nearly ten centuries ago".

It is apparent from the above that the committee consisting of the experts in astronomy, astronomical history, and Indian tradition of astronomy did vote in favor of a Chaldean origin of astronomy and astrology (zodiac) around 1300 BC. Another noteworthy aspect relevant to the context of the present paper is the CRC's conclusions on the initial point of the Indian siddhantic or sidereal zodiac:[17]

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[13] Dikshit, S.B. See reference (10) above pages 66-67.
[14] Holay, P.V. *Vedic Astronomy*, Publisher: Secretary, Babasaheb Apte Smarak Samiti. (1994).
[15] Saha, M.N. and N.C.Lahiri. *History of the Calendar*, CSIR, New Delhi (1992). Pp.194-195.
[16] Ibid. pp. 197-198
[17] Ibid. pp. 183-184

"We do not, however, have any idea as to how the beginnings and endings of the nakṣatra divisions were fixed in India. The prominent ecliptic stars which were used as Yogatārās (junction-stars) in pre-Siddhāntic period, are not distributed at regular intervals along the ecliptic; ...In fact no arrangement at any time appears to have been satisfactory enough for all the Yogataras to fall within their respective naksatra divisions."

This conclusion is enlightening as regards the confusion that the Indian astronomy had inherited even in respect of the most fundamental aspect of the initial point of the Hindu sphere (as Thibbaut chose to describe it). Such a confusion is reflective of a break in the transference of traditional knowledge and the deficiency on account of such gaps in the tradition can only be accounted for by creative steps as has happened in the case of the interpretation of Vedāṅga Jyotiṣa by Holay[∞]. Despite the above confusion of the initial point the Committee headed by M.N.Saha did recommend arbitrarily the point opposite Citra as the zero point under the pretext that the astronomical observations over which the Sūryasiddhānta is based probably had its beginnings around AD 285. On the other hand G.Thibbaut[18] had taken Zeta Piscium as marking the zero and accordingly deduced the scientific beginning of Hindu astronomy as taking place in 572 AD.

These short accounts of Vedāṅga Jyotiṣa and CRC report have been given only to illustrate qualitatively or more correctly to remind all concerned of the complexity and confusion prevailing with the Indian astronomical tradition partly by way of inheritance due to historical causes and the rest created by the widely variant theses that have come up during the last two hundred years of historical research in science. It is against this background that an attempt is being made for a revision of some of the established notions of history of science in the context of astronomy. To strike out a new path in this labyrinth is a difficult task and no single author – howsoever resourceful he may be unable to adequately support each and every one of his sentences or arguments by quoting appropriate authorities. Such a shortcoming doesn't invalidate a thesis provided all such propositions or arguments are consistent with the set of other propositions supported authoritatively in the thesis. In fact, the thesis must receive a wholesome evaluation rather than testing each assertion one by one on the touchstone of 'authority' or 'established notions'. The following words of Einstein I think must be heeded to in historical research as well with modifications relevant to the context:

"In order to be able to consider a logical system as physical theory it is not necessary to demand that all of its assertions can be independently interpreted and tested 'operationally'; de facto this has never been achieved. In order to be able to consider a theory as physical theory, it is only necessary that it implies empirically testable assertions in general."

[∞] Scores of scholars have attempted to decipher the verses with the preconception that the Ṛgjyotiṣa stipulates a five-year cycle and all of them invariably ended up suggesting emendations that suited the interpretation invented by them. Holay's work is a classic example of what creativity will be able to achieve in the field of history of science – the decipherment that the "Pañcasaṃvatsaramayaṃ" implies a 19-Year cycle consisting of the five kinds of years is a feat unparalleled in the history of astronomy.

[18] Thibbaut, G. *Pañcasiddhāntika*, English translation, Introduction.

Further, I am inspired to quote the following words of Bālagaṅgādhara Tilak to convey the need for a new look or revision in our approach to the evaluation of a research work in the field of history of science:[19]

"I wanted to collect together all the facts that could possibly throw any light upon, or be shown to be connected with the question in issue, and if in doing so I have mentioned some, that are not convincing as the others, I'm sure that they will at least be interesting and that even after omitting them there will be ample evidence to establish the main point. I have therefore to request my_critics not to be prejudiced by such facts, and to examine and weigh the whole evidence I have adduced in support of my theory, before they give their judgment upon it".

It is my humble request that the referees may kindly give due attention to the spirit of the above words of Einstein and B.G.Tilak before giving their final verdict on the suitability of the present paper.

Background of the Present Paper

Even though a few of my papers bearing on the decipherment of the true Hindu zodiac or Rāśicakra have already appeared in the IJHS, referees have time and again asked for elaboration of the concepts like say, Mūlādhāracakra or the Indian Tāntric Zodiac. As such I am constrained here to present a bird's eye view of my previous works at the outset.

(a) Astrological Rationale of the Initial Point

Not only the Calendar Reform Committee but also others who have searched for the initial point of the Indian zodiac have done so on the presumption that the zodiac is a circle and as such the choice of the initial point was a matter of calendaric custom or convention. It was primarily on this basis that M.N.Saha and N.C.Lahiri imagined the existence of a tradition beginning with the Citrā's opposite point, which was coincident with the vernal equinox in AD 285. Obviously, AD 285 was the maximum antiquity that the CRC could credit with the Indian conception of the Zodiac i.e, three centuries more than what Thibbaut had imagined.

As against these conceptions, the present author has shown[20] that the initial point of the zodiac has got a physical rationale based on the "Principle of Symbolic Equivalence of the Microcosm and Macrocosm or Man and the Zodiac". This physical rationale in turn demanded an astronomically defined (or identified) physical point over the human body (Jīvapuruṣa) or a physiologically defined (or identified) astronomical point over the Zodiac (Kālapuruṣa-mathematical and astrological abstraction of the ecliptic). Relying on Tāntric literature the above point of bio-cosmic correlation was identified as " Mūlādhāraṃ" which in fact can be translated as 'Mūla the fiducial' by an astronomical interpretation. All this theory was presented only to serve as a support to the conclusions arrived at by a mathematical analysis of the basic computational structure of Sūryasiddhānta.

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[19] Tilak, B.G.*The Orion*, p.iv of Preface. Publisher: Tilak Bros. Pune-30
[20] Chandra Hari, K. True rationale of Sūryasiddhānta, IJHS Vol. 32(3) 1997, pp.183-190

Further, the above paper demonstrated mathematically that the conclusions presented by the CRC about the three zero points of the 'Sūryasiddhānta-tradition' are all nothing but conjectures arrived at by faulty analysis of a wrong data. Since the publication of the above paper, the work has been improved[21] further and by the simple and straight argument of the fixed aphelion it has been demonstrated conclusively that the Indian astronomy and zodiac has a pre-Āryabhaṭa history and the original epoch of Sūryasiddhānata is the vernal equinox of AD 231 that coincided with the Caitra-śukḷa pratipada. This derivation of the initial point, which is at precisely 120^0 east of Mūla, renders further support to the fiducial status of Mūla at 240^0 that marks the bottom of the cerebro-spinal axis of microcosm and macrocosm. The above astronomical fact in turn explained the Tāntric tradition of Phallus worship and the appellation of Phallus-Śiva as 'Mahākāla', and led to the identification of Mūla as the basis of the mythological or allegorical description of Rudra-Śiva.

(b) Babylonian Zodiac as 'Mūlādhāra cakra'

In a subsequent paper entitled 'On the origin of sidereal zodiac and astronomy', which appeared in Volume 33(4) of IJHS (1998) the historical dimension with reference to Vedic literature and the Babylonian connection was explored - but with little details due to the lack of sufficient resources. (The interdependence/correspondence between the two disciplines of Yoga and Jyotiṣa was also explained).

The present work is a continuation of the above theses by incorporating as many evidences as possible to establish that the zodiac had a pre-historic origin in India and the Universal prevalence of its scanty remnants are a pointer towards the spread of Indian ideas in ancient times to the various parts of the world. The work being an attempt to reconstruct the prehistoric astronomical tradition relying on scanty source materials, little kindness may please be shown to the few isolated instances of weak suppositions that might have crept in. As the Babylonian origin around 700 BC stands confirmed in the minds of Western historians of science the thesis on the 'Indian origin of astronomy' is presented below in contrast to the salient features of the theory of Babylonian origin by O.Neugebauer.

O.Neugebauer on Babylonian Influence

O. Neugebauer assigns[22] 700 BC for the beginning of Mesopotamian astronomy. As regards the pre-Seleucid phase Neugebauer observes[23]:

"*We know only very little about the prehistory of this Babylonian astronomy. In the extant texts from the Hellenistic period, almost all methods appear fully developed. On the other hand it is virtually certain that they did not exist at the end of the Assyrian period. Thus one must assume a rather rapid development during the fourth or fifth century B.C.The*

[21] Chandra Hari, K., 'Sidereal zero point - A mathematical solution', IJHS, 35(2), (2000), p.117

[22] Neugebauer, O., History *of Ancient Mathematical Astronomy*, Vol. I, New York, (1975), p.2

[23] Ibid, p.3

same two centuries witness also the first steps in Greek astronomy. The beginning is made by the "School" of Meton and Euctemon (around 430 BC) with observations concerning the length of the solar year and with the formulation of the "Metonic" 19-year cycle which may or may not be independent of the contemporary Mesopotamian discovery of the same cycle..."

In addition, in the context of the 'Babylonian influence' over the world of astronomy we can find[24]:

"*The mere fact itself of Babylonian influences on Hellenistic astronomy is obvious. It suffices to mention the all-pervading use of the sexagesimal system, e.g. in the reckoning of time or in the division of the circle, the presence of Babylonian parameters in Hipparchus' lunar theory, or the frequent use of Babylonian arithmetical patterns in various fields, e.g. mathematical geography, gnomonics, etc. It is much more difficult, however, to determine with reasonable accuracy the time of transmission or the mode of contact and to evaluate correctly the degree and importance of the influence of Babylonian astronomy on the nascent Greek science. Without insight into specific technical details one can easily over emphasize influences, which in fact do not require more than the transmission of a few basic concepts. One has to face still greater difficulties in the evaluation of secondary transmissions, e.g. into India where the problem of Hellenistic and Iranian intermediaries may seem unsolvable*".

The above views of O. Neugebauer are reflective of the general perceptions prevailing on the history of astronomy as well as the sexagesimal system.

•True Origins of Mathematics

Written records of the sexagesimal cum decimal system belonging to periods as early as 2500 BC have been discovered in the remnants of the Sumerian city-states like Ur, Nippur etc. According to George G. Joseph [25] the earliest written records begin around 3500 BC and come to an end with the Persian conquest in 539 BC when Mesopotamia ceased to exist as an independent entity. Sir George Rawlinson[26] also suggests an antiquity of around 3000 BC for the Sumerian Civilization. Neugebauer finds the first use of the sexagesimal notation among Greeks in the works of Eratosthenes, around 250 BC in his division of the circumference of a circle in 60 parts. When we look at India, in the oldest of the literature viz. Ṛgveda there are a number of verses, which reflect the prevalence of sexagesimal & decimal systems along with the place value notation. To cite a few:

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[24] Neugebauer, O. *History of Ancient Mathematical Astronomy* Vol. II, New York, (1975), p.589

[25] George. G. Joseph, *The Crest of the Peacock,* p.91, Penguin.

[26] Adhikari, S.K., has quoted Sir George Rawlinson in the Paper, 'Babylonian Mathematics', Indian Journal of History of Science, 33(1), 1998, p.2

1. Ṛgveda (IV.58.3) describes the "four-horned Bull" as having '4 horns, 3 feet; 2 heads and 7 hands' and apparently, this makes no sense. But in the light of the Atharvaveda hymn (VIII.2.21) that speaks of the Yuga of Indragni as consisting of "100 Ayutas to which are 'added' the digits 2,3 and 4 in succession", the true meaning can be identified.

   Atharvaveda hymm referred above suggests the place value notation and the 'addition' of digits 2, 3 and 4 accordingly to give 432 00 00000 years as the duration of creation. On juxtaposing this to the Rgvedic hymn it becomes apparent that the four-horned Bull is nothing but the great Yuga of 432 000 000 0 (the seven hands as seven zeroes) years. Obviously, this number is a sexagesimal-decimal hybrid of unknown rationale.

2. Ṛgveda (III.9.9) speaks of the addition of 300, 3000, 30 and 9 – the numbers are given in terms of their place-values as hundreds, thousands, tens and ones as per the decimal system.

3. Ṛgveda (I.164.46) and Atharvaveda (X.8.4) give 360 as the divisions of the year while Ṛgveda (I.164.22) has 720 as the divisions of the year. Similar references can be seen at Aitareya Brāhmaṇa (VII.17), Taittirīyasaṃhitā (VII.5.1) etc. Ṛgveda (VIII.46.22) mentions higher numbers such as 1000, 3000, 60000 etc.

4. In the Yajursaṃhitā (Vājasaneyī, XVII.2), Taittirīyasaṃhitā (IV.40.II.4) & (VII.2.20.1), Maitrāyaṇi (II.8.14), Kathaka (XVII.10) etc., we can find the enumeration of place-values of the Decimal system:
   Eka (1), daśa (10), śata(100), sahasṛa(1000), ayuta(10000) .... Parārdha (10^{12})

5. The oldest among the Vedic literature, Ṛgveda itself point towards the existence of a well-developed school of mathematics in ancient India.

   a) II.18.2: "This is prepared for him the first, the second, the third time..."
   b) II.18.4: "Indra, come hitherward with two bay horses, come thou with four, with six when invocated. Come thou with eight with ten to drink the Soma..."
   c) II.18.5 & 6: "O, Indra, come thou hither having harnessed thy car with twenty, thirty, forty horses. Come thou with fifty well-trained coursers, Indra, sixty or seventy, to drink the soma. Come to use hitherward, O, Indra carried by eighty, ninety or an hundred horses."

   We have a mention of the following numeral series in these hymns:
   1,2,3 ... (odd & even numbers)
   2,4,6,8,10 ... (an even number progression)
   20,30,40,60,80,90,100 (use of 10 as the radix)

6. In the Atharvaveda also we can find:

   a) In XIII.5, XX.25 & XVI.18, numerals 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are mentioned in the ascending order. These first ten digits assume importance as a class, only in the Decimal system.
   b) V.16.1.11: The numerals 1, to 11 are mentioned in order, probably to illustrate the formulation of the digits above nine.
   c) V.15.1.11: Numerals from 1 to 10 and 100 are paired with their multiple by 10 i.e. 1-10, 2-20, 3-30, 4-40 ... upto 10-100 and 100-1000 are given to illustrate the process of deriving higher numbers in the decimal system. Had it been a random mention of a few multiples of common use it would have stopped at 10-100, rather than progressing on to 100-1000 i.e. a four-digit number cannot be expected to have ordinary use in those ancient days.
   d) IXX.43.35 gives the multiples of 11 in descending order i.e. 99, 98, 77, 66, 55, 44, 33, 22 and 11.

7. Yajurveda XVII.24 and XVII.25 mentions the odd and even numbers in a unique way as:

   XVIII.24: 1,3,3; 5,5; 7,7; ... 29,29; 31,31; & 33.
   XVIII.25: 4,8,8; 12,12; 16,16; 20,20; ... 40,40; 44,44, & 48

   We can only speculate as regards the purpose served by these series of numbers. Both the series must have certain rationale/process behind it.

8. Taittirīyasaṃhitā (VII.2.12-17):
   1, 3, 5 ... up to 99; (1, 3, 5 ... 33 at IV.3.10 also).
   2, 4, 6, 8 ... 20
   4, 8, 12 ... 20
   5, 10, 15 ... 100
   10, 20, 30 ... 100

9. Pañcaviṃśa-Brāhmaṇa (XVIII.3) and Śṛautasūtras contain the geometrical progression:
   24, 48, 96, ... 49152, 98304, 196608, 393216

10. Śatapatha Brāhmaṇa (X.5.4.7) gives the sum of the series 3 x (24 + 28 + 32 + 36 + 40 + 44 + 48) as 756. Bṛhaddevata (III.13) sums up the series 2 + 3 + 4 + ... 1000 as 500499.

11. Śūlbasūtraḥ gives evidence for the use of arithmetical operations with fractions such as:
    $7\frac{1}{2} \div \frac{1}{25} = 187\frac{1}{2}$

$(2^1/_7)^2 + (½ + {}^1/_{12})(1-{}^1/_3) = 7½$, $7^1/_9 = 2^2/_3$
$7½ \div {}^1/_{15}$ of $½ = 225$ etc.

12. Baudhāyana Śūlbasūtraḥ gives the elementary treatment of surds-addition, multiplication, rationalization etc. – and for e.g. the value of $\sqrt{2}$ can be found as: $\sqrt{2} = 1 + {}^1/_3 + {}^1/_{3.4} - {}^1/_{3.4.34}$

Scholars have speculated as to the possible method of arriving at the above result. Whatever it may be, the treatment of surds point towards a well-developed mathematical school. Sulbasutras also contain the so-called theorem of Pythagoras, Squaring of the circle, construction of right-angled triangle, properties of similar figures etc.

13. In Piṅgala's Chandasūtras we can find the development of the theory of permutations and the results such as $nC_1 + nC_2 + \ldots + nCn_{-1} + nC_n + nC_{n+1} = 2^n$, $nC_r + C_{r+1} = n+1\ C_{r+1}$ are implicit in it. It is likely that Pingala may only be a compiler of ancient results rather than an inventor. Chandah (the science of metres) must infact precede the origin of Rgveda itself and the different metres point towards the existence of numerals and arithmetic operations even in the pre-Vedic period.

14. Taittirīya Brāhmaṇa (III.10.1.1 & III.10.9.7) enumerates the 30 muhurtas of day and a similar notion can be found in Satapatha-brahmana (XII.3.2.5) where the year is considered as 10800 muhurtas i.e. 30 x 360.

15. Atharva Jyotiṣa divides time as:
12 nimeṣas = 1 lava
30 lavas = 1 Kala = 360 nimeṣas
30 Kala-s = 1 truti = 10800 nimeṣas
30 trutis = 1 muhūrta = 324000 nimeṣas

Atharva-Jyotiṣa also gives the shadow-lengths in angulas after every muhurta from sunrise to sunset and in moonlight during night.

These evidences are of course scanty, many of them cannot be dated, and therefore prima facie the clay tables do enjoy an edge over these references as reliable records of a prehistoric age. But the situation changes drastically if we are able to date the Vedic references or the texts like Śūlbasūtras. In this context, the works of A. Siedenberg[φ] and Natwar Jha[ψ] assume a lot of significance. Siedenberg has shown that the foundation of

[φ] Seidenberg, A. (1). 'The Ritual Origin of Geometry', *Archive for History of Exact Sciences*-1,1962, pp.488-527. (2). 'The Origin of Mathematics', *Archive for History of Exact Sciences*-18, 1978, pp.301-342.
[ψ] Jha, N. (1). Vedic Glossary On Indus Seals, Pub: Ganga Kaveri Publishing House, Varanasi, 1996.
According to Dr.Jha, Vedic civilization had its spread in the 'sapta-sindhu pradeśa' referred to in Ṛgveda X. 75-5. He has quoted Chapter 342 of Mahābhārata – śḷokas 71-73, 88-89, and 92-93 as specifically referring to

both the Egyptian and old Babylonian mathematics is the Śūlbasūtras. Natwar Jha on the other hand by deciphering the Indus script has rendered irrefutable evidence towards the fact that the Indus Civilization had Sanskrit as the language and was Tāntric / Vedic in character. This discovery in turn establishes the great antiquity of the Sanskrit literature as is evident from the astronomical references. Against the background of the above discoveries the scanty references to mathematical ideas / operations and the astronomical phenomena that we come across in Vedic literature in fact assumes greater significance and point towards the deficiency of our approach in relying exclusively on archaeology for writing the history of Mathematics and Astronomy. It becomes apparent that we must have a more creative approach in working out the implications of such isolated references occurring in texts, which are un-related to the subject proper. Further, what about their astronomy if the foundations of Babylonian mathematics are borrowed from the Vedic civilization? First or the old Babylonian empire had its existence during BC 1900-1650 i.e., the empire was established around the drying up of Sarasvati and the decadence of the Indus civilization. According to the chronology given by George G. Joseph, development of Babylonian astronomy took place after the fall of the Old empire since 1600 BC and if it is so there exists the possibility that the Babylonian astronomy may be the contribution of the Tāntric/Vedic cults that migrated towards west as a result of the increasing hostility of their old habitats on the banks of Sarasvati. When we look into the salient features of the astronomical tradition of both the places this speculation no more remains so as it receives substantiative evidences.

• Indian versus Babylonian Astronomical Tradition

Pre-historic Cultural Tradition of India - Significance of Time and Astronomy -Removed as the matter has become the content of earlier chapters

Babylonian Tradition of Sidereal Zodiac

[A few quotes given here have already appeared in chapter1; but have retained them here to facilitate easy reference]

The most striking resemblance of the Babylonian zodiac is the fact that it is sidereal like

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the subject matter depicted on certain Indus seals. Śḷoka 73 mentions the recovery of lost Nirukta by Yāska while śḷokas 92 and 93 speaks of the two most popular depictions on the seals viz., the Unicorn Bull (ekaśṛṅga) and the humped bull (trikākūt) respectively. I have no doubt as to the correctness of this spectacular discovery –a creative leap over the earlier absurd scholarly inventions. The high antiquity of not only the Vedas but also of the entire Vedic literature including the Brāhmaṇas and Upaniṣads can no longer be doubted and the credibility of Vedic literary evidence stands reestablished to an irrefutable level. Moreover Jha has brought to light the existence of Śaiva - Āgama, Śvetāśvatarōpaniṣad and Yoga in the days of the Indus Valley civilization. The confirmatory evidence rendered by Jha's decipherment offers great solace for scholars who have been steadfastly stuck to the proposition that the Indus civilization can only be Vedic in character. History as created by people like John Marshall, M. Wheeler and D.P.Chattopadhyaya is in dire need of revision as the Aryan myth has crumbled with the surfacing of Sanskrit glossary in the ruins of Indus Valley civilization.

the Indian Tantric zodiac, which takes Mūla (λ-Scorpii) as fiducial at 240^0. According to O. Neugebauer the change from the older irregular zodiacal constellations to the familiar coordinates of longitudes in the fixed zodiac of 30^0 signs took place around 500 BC in the Achaemenid period. This fixed zodiac of constellations differed from the modern tropical zodiac in the basic conception of the initial point and Neugebauer gives the following description in contrast:[27]

"The reckoning in the Almagest of the 360 degrees of longitude, beginning at the vernal equinox, called Aries 0^0, is of course, related to the discovery of precession and the resulting decision to define the solar "year" as the tropical year. In accepting this definition, one completely severs all relations between the zodiacal signs determining longitudes and the zodiacal constellations. In Babylonian astronomy, no distinction was made between tropical and sidereal year. Longitudes were not counted from the vernal point but from the sidereally fixed endpoints of the zodiacal signs, i.e. in terms of signs and degrees from 0 to 30, not in degrees from 0 to 360. In this fixed ecliptic the equinoxes and solstices were located at certain points, in "System A" at the 10th degree, in "System B" at the 8th degree of their respective signs..."

In the context of our discussion, it is necessary to investigate the basis of these two systems differing by 2^0 as regards the location of the vernal point.

Vernal point in the 8th degree

O. Neugebauer has quoted several instances of the appearances of this zodiac among Greek and Roman sources. Star catalogues of the Seleucid era also reflect the fall of vernal equinox in the 8th degree[28]. Neither Neugebauer nor any other authority could so far explain the rationale behind this choice of the initial point. It is therefore apparent that no explicit mention of the rationale of zero point or of the fiducial star could be found in the clay tablets unearthed so far. As in the Indian tradition, if we consider Mula as at 240^0, the ȧyanamsa (arc difference between the vernal point and the zero point) at the beginning of the Seleucid Era i.e. (–) 311 will be 7°32' i.e. in the 8th degree. This arc difference would have been exactly 8.00 degree in (–) 345. Perhaps, this was the last time when Babylonians had the true notion of their zero point as lying 8^0 west of the vernal equinox and this norm as such did not undergo any modification subsequently. The norm remained in use even during the first five centuries of the Christian era among the Greeks and Romans.

Vernal point at Aries 10^0

Certain authorities[29] have referred to this tradition as arising from the time of Meton, who is said to have inaugurated the 19-year cycle in Athens on (–) 431 June 27[30]. So the

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[27] Neugebauer, O. *History of Ancient Mathematical Astronomy* Vol. II, pp. 593, New York, (1975)
[28] Ibid p.546, p.596-598
[29] Ibid p.598 & 496
[30] Ibid p.588

possibility that Meton might have borrowed the Zodiac and the 19-year cycle from Babylon cannot be ruled out. The summer solstice of (-) 431 corresponded to: UT (-) 431 June 28, 08:40. JD 1563813.8611, Monday, and with Mula as fiducial at 240^0, the summer solstice was precisely at $09^0 11'$ of Cancer - i.e., in the 10th degree since BC 490.

Regression of the vernal equinox in the fixed sidereal zodiac during the period since 4137 BC can be understood from the following table:

Vernal Equinox at:	Date
60^0	4137BC
50^0	3401 BC
$46^0 40'$	3157 BC
40^0	2670 BC
$36^0 40'$	2427 BC
30^0	1941 BC
$23^0 20'$	1457 BC
15th degree	852 BC – 780 BC
10th	490 BC – 418 BC
8th	346 BC – 274 BC
6th	201 BC – 129 BC
5th	129 BC – 57 BC

The earliest of the Babylonian tradition places the vernal equinox at Aries 15^0 and accordingly the epoch belongs to 9th century BC – the period of Assyrian empire at Nineveh. Even though the 8^0 norm became popular with the different authors of the outer world (as quoted by Neugebauer), the sidereal initial point continued to prevail among the astrologers of Greece. In the words of Neugebauer:[31]

"If we assume that around 300 BC the vernal point was given a sidereal longitude (i.e. reckoned with respect to a certain fixed star) of about 8^0 or 10^0 then its sidereal longitude around the beginning of our era would be, because of precession, in the neighborhood of 5^0. This is in fact the order of magnitude of the deviation between modern (i.e. tropical) longitudes and longitudes given in Greek horoscopes. In other words the astrological literature of the hellenistic – Roman period still preserves the norm of Babylonian astronomy."

- **Babylonian versus Vedic Astronomical tradition**

As far as the Indian tradition is concerned so far no direct archaeological evidence is available to establish the presence of a fixed zodiac in ancient times. But the evidence of

[31] Ibid p.594

"Mūlādhāra Cakra" as described earlier and the tradition of Phallus[ψ] worship that has come to light through the excavations at Harappa is an indirect pointer towards the existence of the sidereal fixed zodiac and its extreme significance as the synonym of Time. The fiducial longitude 240^0 of Mūla over the celestial zodiac symbolically corresponded to the position of the Phallus (Liṅga) over the human zodiac. Mūla i.e. mythologically Rudra was therefore worshipped as Liṅga. In other words Liṅga symbolically marked the location of the fiducial star and was therefore worshipped as a symbol of Time or Rudra/Mahākāla. A number of literary references are available that suggest the existence of the above Tāntric stellar fixed zodiac among the Vedic cult:

Ṛk-jyotiṣa

Ṛk-jyotiṣa[32] had been a bunch of obscure verses since its known history. Despite the innumerable emendations suggested by the various scholars, rationale of the verses could not be understood and defied all attempts for a consistent interpretation until the advent of P.V. Holay on the scene. Holay's interpretation of Vedāṅga Jyotiṣa was first published in Marathi in 1986 and in English in the year 1989. With very little emendations, Holay has shown that the Ṛk-jyotiṣa verses are consistent with the 19-year cycle and on this basis the rationale of the verses have been brought out quite ingeniously. According to Holay's interpretation, the 19-year Yuga begins on the full-moon day when the sun is at the east-end of the Śṛaviṣṭhā division on the winter solstice day. Based on the sidereal stellar zodiac beginning with Aśvini, the above epoch of Ṛk-jyotiṣa corresponds to the fall of solstice across $306^0 40'$ in/around 2435 BC. As against this estimate of the antiquity of Vedāṅga Jyotiṣa, the earlier interpretations and dating of the epoch was around 1350 BC.

O. Neugebauer has expressed certain reservations regarding the efforts by modern astronomers to examine the observational basis of ancient references in the light of modern astronomical accurate computations. Such reservations may have some significance in the context of Babylonian arithmetical schemes, which do not suggest a specific epoch. That is not the case here as the astronomical phenomenon referred above i.e. full moon over laying the solstitial line across $306^0.666$-$126^0.666$, had a clear "observational identity" in the achronal rising of Maghā (Regulus) or Alpha Leonis having a sidereal longitude of $125^0 14'$. Acronycal rising of Regulus heralded the impending

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[ψ] *Worship of the genitals:* This is commonly theorized as an aboriginal practice of the fertility cults and we can't find a more eccentric conception in the annals of any other culture. But the astronomical rationale of 'Mūlādhāraṃ' is illustrative of a mathematical, astrological and yoga basis. Śiva and Pārvati, who are worshipped as the Liṅga and Yoni are the mythological preceptors of the disciplines of Jyotiṣa and Yoga. This symbolism arose out of the mathematical abstraction of the ecliptic into the symbolic zodiac as per the principle of symbolic equivalence of the microcosm and macrocosm. Zodiac in fact formed the Kālacakra and in this conception the nakṣatra Mūla was defined to be of a fixed longitude 240^0 and the special status of being a fiducial star. This in turn gave Mūla a cardinal importance in matters such as calendar and other aspects of Jyotiṣa, which were important to the discipline of Yoga. The term "Kuṇḍalini" in fact is reflective of the inseparability of the two disciplines of Yoga and Jyotiṣa. In Yoga, Kuṇḍalini is realized as a power while in Jyotiṣa the term refers to the horoscope. Mūla's cardinal role as Mūlādhāraṃ inspired the Tāntrics to personify it as Liṅga and Yoni as Mūla marked the position of the genitals over the human body conceived as the Zodiac by the principle of symbolic equivalence.

[32] Holay, P.V. *Vedāṅga Jyotiṣa,* Publisher: Baba Saheb Apte Smarak Samiti, Nagpur.

solstice on the next day and the full moon had a rapt conjunction with the Regulus placed over the ecliptic. The situation is analogus to the acronycal rising of Mṛga that marked the fall of autumnal equinox over Mula on the next day. With the help of the above "observational identity" the epoch can be precisely determined as:

- **16th Tithi Marking the New Yuga (19-year cycle)**

UT: (-) 2423 January 08, 11:03. JD = 836064.96042, Sunday
Tropical Sun = 270^0, Tropical Moon = 101^0 16' 23"
Precession relative to Mūla as fiducial at 240^0 (Ayanāṃśa) = 36^0 37'
Sidereal positions: Sun = 306^0 37', Moon = 137^0 54', Tithi: 16th (Kṛṣṇa 1)
On the evening of 7th January at the Indian longitude of Ujjain, Moon rose in rapt conjunction with Regulus and marked the beginning of the Yuga next day.

- **15th Tithi Marking The New Yuga (19-Year Cycle)**

UT: (-) 2434 January 07 18:48, JD = 832046.2833
Tropical longitudes: Sun = 270^0, Moon = 86^0 02'
Ayanāṃśa (with Mula as fiducial at 240^0) = 36^0 46'
Sidereal longitudes: Sun = 306^0 46', Moon = 122^0 46'

Sunrise on the next day had simultaneous Moonset in conjunction with Regulus (Maghā) to mark the Yuga-beginning on the 15th 'Tithi'. The cycle repeats after 19 years as for example on: UT: (–) 2415 January 08,09:15, JD 838986.8854. We have again the case of (b) with Sun = 270^0 and Moon = $81^0$45'. Full-Moon setting with Regulus heralded the beginning of the Yuga magnificently. Either of the above two phenomena might have served as the "Observational identity" for the beginning of the year.

- **Yajur-Jyotiṣa**

According to Holay's interpretation, Yajur-jyotiṣa exhibits a marked degeneration in the astronomical content as compared to the Ṛk-version. The 19-year cycle was replaced with a crude five-year cycle contrary to the refinement that we may expect a posterior epoch. The epoch corresponded to the fall of solstitial line and new moon across $293^0$20' – $113^0$20' i.e., Dhaniṣṭhādi. The method of intercalation became very crude probably because of the loss of observational identity for the 'Yuga-beginning'. The epoch can be computed as around:

UT: (-) 1447 January 01, 18:38; JD1192542.2768, Ayanāṃśa = (+) $23^0$12'

Tropical Sun and Moon were respectively at 270^0 and $266^0$33'. This epoch having vernal equinox in the 24th degree of Aries represents the degenerative phase of the Vedic cult after the complete drying up of Sarasvati around 1900 BC.

Apart from the above two major epochs Vedic literature contain references to the intermediary epochs such as:[33]

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[33] Bedekar, V.M. and G.B.Palsule, *Sixty Upaniṣads of the Veda,* Vol. I, Motilal Banarsidass, Delhi

• **Maitrāyaṇa Upaniṣad VI.14**

"Ardhamardhaṃ Vāruṇaṃ Maghādyaṃ Śṛaviṣṭhārdhabhāgneyaṃ
Kṛameṇōtkṛameṇa Sārpādyaṃ Śṛaviṣṭhārdhāntaṃ Saumyaṃ ..."

Here we find an explicit description of the Zodiac having 108 stellar quarters i.e., nakṣatra-padas or navāṃśas with the solstitial line across $300^0 - 120^0$. The epoch as per modern computation as above will be BC 1941 – probably the crucial epoch at which Sarasvati disappeared.

• **Viṣṇu Purāṇa II.8: 77- 79**

Prathame krttikābhāge yadābhāsvaṃtstadā śaśī I77I
Viśākhānāṃ carurttheśe mune tiṣṭhati asaṃśāyaṃ
Viśakhānāṃ yadā Sūryaścaratyaṃśaṃ trtīyakaṃ
Tadā Candraṃ Vijānīyād Kṛttikāśirasisthitaṃ |78|
Tadaiva Viṣuvākhyōyaṃ kālaṃ puṇyo*f*bhidhiyate |79|

In this Purāṇic verse, the positions of sun and moon are mentioned in terms of the nakṣatra-pāda, namely, sun transiting into the 3rd pāda of Viśākhā (206^0 40' – 210^0) and moon at $26^0$40' (top of Kṛttikā-nakṣatra division) coinciding with the full moon. The epoch will be around 1700 BC and the vernal equinox will be in the 27th degree of Aries. By modern computation, this observation can be located as the full moon of UT:(-) 1701, 4th April, 17:24. JD=1099861.225. Ayanāṃśa = (+) $26^0$42'56".

• **Earlier Purāṇic Epochs**

The Ṛk-jyotiṣaḥ epoch viz., Māgha pourṇamī coinciding with the achronal rising of Regulus on the winter solstice day of 2435 BC represents a well-attested tradition. B. G. Tilak has discussed at length the different aspects of the related verses from the Vedic literature in the light of Jaimini's interpretation. Mahābhāratah, Aśvamedhikā parva 85.8 also probably refers to the year beginning with Māgha-pūrnimā and solstice. The observational identity of the epoch/year-beginning as reflected in the above is nothing new to the Indian tradition. Around 3000 BC, the Rohiṇīs probably provided with a more spectacular identity to the year beginning in the achronal rising of Jyeṣṭhā-rōhiṇī. As for example an epoch similar to the above one can be located as: UT: (-) 3048 April 15. JD = 607880.691; Ayanāṃśa = $45^0$11'. Tropical Sun: 0^0 0', Moon: 172^0 03'. At the Indian longitudes moon set on the morning of April 16 in conjunction with Antares (∝-Scorpii).

Kaliyugādi

Siddhāntic astronomy places 'Kaliyugādi' at the midnight of 17/18 February 3102 BC – an apoch neither sidereal nor tropical. Obviously, this 'Kaliyugādi' is the result of some Siddhāntic back computation and has no connection with the calendaric phenomena of those days. Western scholars like Cyril Fagan considered the fall of equinoxes over the Rohiṇīs as a great epoch of humanity i.e., in the Indian context nothing but Kaliyugādi. No body could have thought about the existence of a mathematical zodiac in those 'early days of culture' until the discovery of the true sidereal zodiac – Mūlādhāra Cakra. In the

light of the epochs of Vedāṅga Jyotiṣa and Maitrāyaṇa Upaniṣad VI.14, it can be conjectured that the equinoxes and solstices of Kaliyugādi also might have marked the boundaries of the navāṃśa divisions of the zodiac. If we look for such a configuration near 3102 BC with Mūla as fiducial at 240^0, we get the equinoxes and solstices to be at $46^0 40'$, $226^0 40'$, $136^0 40'$ and $316^0 40'$ respectively, in the year (-) 3157 or 3158 BC. At this early epoch Aldebaran (α-Tauri of Sidereal longitude = $45^0 12'$) and Antares (α- Scorpii of Sidereal longitude = $225^0 11'$) could have guided/heralded the year beginning as these antipodic stars are exactly 1.5^0 west of the equinoxes. The year beginning would have been 1½ day ahead of the achronal rising of either of these stars. As for example: UT: (-) 3162 April 16, 13:38; JD = 566243.068. Tropical sun $=0^0$, moon = $178^0 00'$.i.e.full moon coinciding with the vernal equinox at $46^0 40'$ of the sidereal zodiac.

Apart from Kṛṣṇa's statement, "Māsānāṃ Mārgaśīrṣōhaṃ" quoted earlier, Mahābhārata contain other references to this ancient tradition such as Anuśāsana parva 106-17 & 109-3 where the months are mentioned beginning with Mārgaśīrṣa and ending with Kārttikā. Further, at 110-3, Bhīṣma instructs Yudhiṣṭhiraḥ to begin the worship of Moon from the Mārgaśīrṣa Śukḷa-1 coinciding with Mūla nakṣatra. The original epoch is: UT: (-) 4136 October 23rd 01:14:35 JD = 210679.5518. Sun & Mūla were coincident at 240^0 of the sidereal longitude and the autumnal equinox. Imprints of these distant epochs are visible even today in India's cultural life in the form of religious observances/celebrations, epic/purāṇic mythological characters etc.

In toto, we have Vedic references for vernal equinox falling in the 37th degree (or 7th degree of sidereal Taurus), 24th degree as well as at intermediary epochs of 30^0 and 27th degree i.e. 37, 30, 27 and 24 in succession. Vedic literature does not speak about any subsequent epoch and the sidereal Tāntric/Vedic zodiac then reappears in Babylon with the 15^0, 12^0, 10^0 and 8^0 norms for the cardinal points. Scholars may dispute the reference to "vernal equinox in the 24th deg. of Aries" because of the established notion that the zodiacal signs or Rāśis were not known in India in those days. Such an attitude will be unfortunate, we may use the available references to establish certain facts, but the absence of a particular reference cannot be used to deny the existence of a conception like the Rāśis. In the light of the above discussion on the Vedic references to the Sidereal zodiac it can be conjectured that as a result of the drying up of Sarasvati the Vedic cults partly migrated to the west and they gave shape to the Babylonian astronomical tradition in the period since 1900/1400 BC.

- **Babylonian Evidences of Indian Origin**

In addition to the continuity of the Indian sidereal astronomical tradition, the Babylonian astronomy is replete with internal evidences that clearly suggest Indian origin.

Use of 'Tithi'

The arithmetical structure of 'the Uruk scheme' belonging to the 4th century BC (Seleucidera) testifies the use of Tithi as the fundamental unit in Calendaric astronomy.

As against this prevalence of Tithi in the 4th century BC at Babylon[34] India has an explicit record of its use in the Ṛk-jyotiṣa of 25th century BC. But O. Neugebauer has wrongly interpreted the presence of Tithi in India as reflective of the Babylonian influence.

19-Year Cycle

According to Neugebauer:[35]

"...the invention of the 19-year cycle, or at least its first practical use, seems to belong to the century between (–) 500 and (–) 400. Meton is said to have inaugurated the same cycle in Athens in (–) 431."

Nothing can be more far from the truth as is evident from Ṛk-jyotiṣa. Epoch of Meton's 19-Year cycle is UT: (-) 431 June 28,0840, Monday JD = 1563813.8611, in contrast to (–) 2423 / (-) 2434 of Ṛk-jyotiṣa. Moreover, the 'observational identity' of the Ṛk-jyotiṣa epoch is lacking in the case of the Metonic epoch. The 19-year cycle deciphered from the clay tablets, follow the same pattern as the Ṛk-calendar except for the fact that the Indian year beginning was at winter solstice while the Babylonian year begins at summer solstice. 'Epact' of the 19-year cycle given by Neugebauer (e=11;3, 10^{τ} =11.052778) is the same as that of Ṛk-jyotiṣa and thus in both the traditions year had a length of 371 tithis approximately. Further, each tithi had nine subdivisions known as Bhāṃśas and thus the year had 371 x 9 = 3339 bhāmśas and this is reflected in the Ṛgvedic hymm III.9.9.

The 'arithmetical' nature of the Uruk scheme is another remarkable similarity with the Ṛk-jyotiṣa. Ṛk-calendar had provisions for the classification of years based on the 'tithi of year-beginning' and arithmetical methods (mean computation) to find out the tithi and nakṣatra of the solstices and the vernal equinox. Undoubtedly the Uruk scheme is derivable from the Ṛk-jyotiṣa rules. In fact, we have no other known source of the 19-year cycle and the arithmetical scheme of Uruk tablets. The following observations of Neugebauer are noteworthy in this context:[36]

• "The history of the 19-year cycle is still much in the dark; it is only certain that it is a comparatively later invention ..."

• "While the investigation of the Uruk scheme leaves no doubt about its equivalence with the 19-year cycle, the historical question of its time of origin remains completely in the dark. It seems plausible to consider the strict Uruk scheme as of some later origin than the 19-year cycle. But we know so little about the chronology of the cycle itself that it is impossible to derive from it conclusions about the invention of the detailed solstice-equinox pattern..."

In addition, Neugebauer says that the mathematically derived solstice-equinox-Sirius dates (depending exclusively on the Tithi cycle) shatter the traditional belief in extensive

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[34] Ibid. pp. 358-359
[35] Ibid. p. 355
[36] Ibid p.362

Babylonian observational activities, stretching over a great length of time. Under these circumstances, the mystery of the origin of the 19-year cycle and development into an arithmetical scheme suggests borrowing from an external source and this external agency can only be the remnants of the Vedic/Tāntric cults.

Length of Daylight

Much ado has been made about the ratio of the longest day to the shortest viz., 3:2 visible in both the Babylonian astronomy and Ṛk-jyotiṣa. Babylonian epoch under reference is the Seleucid era that began in 312 BC, while Ṛk-jyotiṣa belongs to 2400 BC. Despite this huge difference in antiquity, almost all scholars have proposed a Babylonian origin for the above ratio, based on the latitude determined from the daylengths at the solstices. This is a good example for the way in which modern scholars impose new meanings on old traditions.

Conventional Analysis

A number of scholars[37] including Neugebauer have derived the latitude of observation of the above ratio for daylight in the following manner:

Daylight hours = $(2/15^0)\ Cos^{-1}\ (-\tan\phi.\ Tan\ \delta)$, where ϕ is the latitude of the place and δ is the declination of the sun.

According to Ṛk-jyotiṣa, Day hours = (12 + 2 D/61) x 0.8, where D is the number of days elapsed or remaining, relative to either of the solstices. At the summer solstice, the day-length will be 18 muhūrtas [14.4 hours] and at winter solstice 12 muhūrtas [9.6 hours]. If we take the maximum declination of sun as $\pm 23^0\ 27'$, Day hours = $(2/15^0)\ Cos^{-1}\ (-\tan\phi.\ \tan\delta)$ = 14.4 or 9.6 or, $-\tan\phi.\ \tan 23^0 27' = \cos 108^0$ or $\cos 72^0$. On solving the above, we get ϕ as $35^0.5$. On this basis, Indian authors and D. Pingree has suggested a Mesopotamian origin to the above dictum of daylight hours. As the Babylonian latitude is only $32^0.5$, Neugebauer observed:[38]

"This shows that the Babylonian parameters are, as to be expected, far from accurate, but still correct within a reasonable order of magnitude. As we have seen Ptolemy could compute ϕ from M (longest day) and conversely by formulae equivalent to (4)$^{\Psi}$. Hence accepting (1), (i.e. the ratio 3:2) the customary characterization for the latitude of Babylon he had to obtain, as we do, a value for ϕ very near to 35^0. This is indeed the geographical latitude assigned to Babylon in his "Geography". A value, conveniently rounded for the computation of Babylonian ephemeredes by means of arithmetical methods, caused a distortion of the ancient, and hence mediaeval, maps of the Near East by $2^0½$ in latitude, substituting the location of, e.g., Samarra for Babylon. Nothing would have been easier than to measure ϕ directly; that this had not been done, or at least had not become known to Alexandarian astronomers during the 500 years or so which separate Ptolemy

[37] Debiprasad Chattopadhyaya, *History of Science & Technology in ancient India*, Firma KLM, Calcutta.
[38] Neugebauer, O. *History of Ancient Mathematical Astronomy*, Vol. II, pp. 367, New York.
Ψ i.e., $\tan\phi = (-)\ Cos\ M/2.\cot\varepsilon$

from the beginning of mathematical astronomy in Mesopotamia is a typical example of the absence of a scientific organisation in antiquity".

Prima facie, a long quotation of this kind may look quite unwarranted. However, here I have given it in view of certain valid inferences that can be drawn from the above observations of Neugebauer:
→ Ratio 3:2 is not valid even for Babylon
→ In view of (1) above, it is possible that the ratio did not originate in Babylon during the Seleucid period.
→ Babylonians only subscribed it without the real meaning.

• **Substantiation for all these inferences can be found in Ṛk-jyotiṣa:**[39]

As per Ṛk-jyotiṣa verse 22, twice the number of days elapsed from the winter solstice divided by 61 gives the increase in daylight muhūrtas during that period. Therefore, Ṛk-jyotiṣa stipulates an extra-muhūrta of day light for every 30.5 days since the winter solstice and for half the year (183 days) theoritically there will be an increase of six muhūrtas from 12 to 18. Based on this rationale let us try to see the position at true Babylon of latitude $32^0.5$ and at latitudes 35^0 and $26^0.5$.

Day light hours =[2/15]. Cos^{-1} [-tanϕ. tanδ]

Sun $\omega_{max}=24^0$		**Day light hours at latitudes**		
λ	δ	35^0	$32^0.5$	$26^0.5$
30^0	$11^0.734$	13.115	13.0138	12.7925
45^0	$16^0.715$	13.618	13.4706	13.1481
60^0	$20^0.625$	14.037	13.8498	13.4421
90^0	24^0	14.422	14.197	13.71
Increase in daylight hours				
Sun moving from 0^0-30^0		1^h07^m	1^h01^m	48^m
Sun moving from 60^0-90^0		23^m	21^m	16^m

It is true that at 35^0 latitude day length is 14.42 hours = 18 muhūrtas. However, this is not the meaning evident in Ṛk-jyotiṣa. Ṛk-jyotiṣa states that the daylength varies by one muhūrta in 30.5 days - and this is possible only when the sun moves from 0^0 -30^0 at a *latitude of 26.5^0. It was impossible to observe this basic phenomenon at 35^0 or 32^0* latitudes where the respective variations are more than one hour instead of 48 minutes (muhūrta). Near to the solstices, the variation in daylength for 30^0 longitudes of Sun is less than 24 minutes (½ muhurta) instead of 48 minutes. It is therefore obvious that the Ṛk-jyotiṣa statement does not correspond to observations near the solstices and on the

[39] Yukio Ohashi, Development of Astronomical Observation in Vedic and Post-Vedic India, IJHS, 28(3), 1993

contrary, the daylight hours at solstices were obtained by a blind theoretical linear extrapolation of the data from the vicinity of the equinoxes. Unfortunately the consequent ratio of the longest to the shortest day got widely subscribed and became a part of the traditional wisdom as can be understood from the references available in Pitāmahasiddhānta[Ψ] and Viṣṇupurāṇa. These extrapolated limiting values of 18 and 12 muhūrtas were as such could not have been relied upon to determine the latitude of observation. As these limiting values were subscribed by Babylonians without the true Vedic connotation - even Ptolemy misinterpreted the data considering it as arising out of observations at Babylon of 35^0 N latitude. In the light of the above analysis, it becomes evident that the "3:2 Babylonian arithmetical, non-observational norm of daylight hours" originated in India at latitudes of 26^0- 27^0 from observations near the equinoxes. Length of daylight thus becomes an irrefutable evidence for the Indian origin of Babylonian astronomy. (The maximum of declination of 24^0 was true around 3000 - 4000 BC.)

• **Planetary Theory – Babylonian versus Indian**

(a) Extinction of the original Sidereal tradition in India

The salient features of the Babylonian planetary theory as outlined by O. Neugebauer do have remarkable resemblance with the methodology of a latter phase of Indian astronomy about which we have concrete evidences only in the period after fifth century AD. As regards the sidereal zodiac and the 19-year cycle, undoubtedly the priority of invention lies with the Vedic / Tāntric phase of Indian culture. If we superficially compare the Siddhāntic astronomy beginning with Āryabhaṭīya of AD 500 to the Babylonian planetary computations, the archaeological evidence of 3rd /4th century BC available in Babylon obviously renders the credit of original invention to Babylonians. But it won't be prudential to consider Āryabhaṭīya as the beginning of the Siddhāntic Planetary theory in view of the existence of Sūryasiddhānta in different versions, which are not datable. Further, the legend of Mayāsura adds another component of intricacy to the question of originality. As such the real situation can be deciphered only on the strength of analysis and in this context, the salient features that merit our attention are:

• The purpose of creation of the ephemeredes giving day-by-day planetary positions is not evident from the Babylonian records. On the other hand, in India, the Vedic and the Tāntric traditions had crucial dependence over astronomical information. Even today, astronomy remains the backbone of the Hindu way of life.

• The original formulation of sidereal zodiac took place in 4137 BC among the Tāntric cult and since then there might have been many bright and dark phases of astronomical development as well as sharing of knowledge between Babylon and India. Strong cultural bonds and even the possibility of Indian settlements in Mesopotamia can't be ruled out. The impetus for astronomical observations and development could have been only from

[Ψ] Referee has sought a clarification for the occurrence of the ratio 18:12 in purāṇic texts. The explanation is that the people extrapolated the variation given in Ṛk-jyotiṣa as if it was true for the whole period from equinox to solstice. This was not the case of the variation given, as it was true only for 30.5 days from the equinox. Here we can see the difference between an astronomical text that gives the correct position and the Purāṇas, which depict the popular aspects.

an Indian Vedic / Tāntric influence. It is apparent from the Phallus and Serpent worship that the Tāntric Sidereal zodiac "Mūlādhāra Cakra" prevailed all over the regions from Middle East to the Far East, if not all over the ancient civilizations. Probably this ancient tradition later on branched out into different schools of astronomy in different places such as Greece / Alexandria, Mesopotamia etc., in addition to the original Indian School.

• Unfortunately, India has no archaeological or other records to substantiate the development of siddhantic astronomy around the beginning of Christian era or in the preceding few centuries. It can only be gleaned from references of Sūryasiddhānta that a pre-epicyclical theory existed in India before the Siddhāntic phase.

• The only logical and scientific explanation for the existence of two different norms for the vernal equinox in Babylon i.e. in the 8^{th} and 10^{th} degree is the precession of the equinoxes. Neugebauer has expressed reservations in this regard:[40]

"Babylonian "longitudes" are always reckoned by zodiacal signs ♈, ♉ etc., but the cardinal points of the solar year are not located at the zero points of their respective signs, but at 10^0 in System A, at 8^0 in System B. One must not ascribe to this norm any deeper astronomical significance. The zodiacal signs originated, of course, from irregular constellations... When finally the irregular configurations were replaced by real ecliptic coordinates in signs of equal 30^0 length the sign "Aries" obtained by some accidental compromise such a position within the constellation Aries that the vernal equinox took place when the Sun was at the 10^{th}, respectively 8^{th} degree of the sign. We do not know what chronological relation existed between these two norms and what caused the difference. We have no evidence from Babylonian sources about a recognition of precession and we have no reason to assume that the difference of zero points in system A and B had anything to do with it knowingly or unknowingly..."

In view of the discussions we had under earlier sections, Neugebauer is wrong and the zero of the Babylonian zodiac had an Indian-definition. Stellar longitudes of the Seleucid era (corresponding to the "8^{th} degree norm" of (–) 311) as well as the data of Kugler and P. Huber quoted by O.Neugebauer confirm the identification with Indian Mūlādhāra Rāśicakra. According to Kugler in (-) 120 Aries 0^0 had a tropical longitude of $-4^0.6$ while P. Huber showed that in about (–) 100, λ_{Bab}-λ_{modern} = $4^0.467 \pm 20'$. These values have remarkable agreement with the respective ayanāṁśas of the Indian zodiac viz., $4^0.9$ in (-) 120 and $4^0.6$ in (-) 100. A pertinent question arises now:

• If the Indian zodiac existed over Babylonia around 100 AD, what about the original Indian school of astronomy -It had been extinguished by that epoch due to the vagaries of time? What can be the cause of the discontinuity in tradition?

[40] Neugebauer, O., *History of Ancient Mathematical Astronomy,* Vol. I, pp. 368, New York.

The only answer to the above questions is 'Hipparchus' and the epicyclical model. Ptolemy's Almagest had no preceivable influence on the Indian scene but the pre-Ptolemaic Hipparchian zero (vernal equinox) and the Epicycle model of Apollonius together got incorporated into the Indian astronomy and the 'humbug' creation wiped out the original tradition and the true rationale of the sidereal zero point. Mayāsura who got the wisdom from Sun can be an Indian disciple of Apollonius, who later on modified the original Sūryasiddhānta. As observed by Sengupta certain verses of Sūryasiddhānta point towards the existence of a pre-epicyclical astronomy similar to that of Babylon in India.

Apart from Sūryasiddhānta, Pañcasiddhāntikā and the Kerala tradition also depict a hybrid character i.e., a mix-up of the 'Babylonian' and the Greek concepts. As we saw earlier, Kerala even today has the remnants of a prehistoric Tāntric tradition and sidereal astronomy in the customs of worship and calendar. Moreover, in the light of the above hypothesis, it can be realized that the pre-Āryabhaṭa astronomy of Kerala in fact reflects all the important features of Babylonian astronomy as deciphered and cited by western scholars like O. Neugebauer.

• Essence of Babylonian Methodology

(a) Neugebauer describes the Babylonian approach as follows:[41]

"*The basic methods of Babylonian astronomy are undoubtedly "arithmetical" in character. In marked contrast to the Greek approach, the first goal of the Babylonian lunar and planetary theory is not the determination of the longitude λ of a celestial body as a continuous function $\lambda(t)$ of time. Instead the attention is concentrated on specific events, e.g. new moons, or consecutive stationery points for a planet. For these isolated events one tries to determine their spacing on the ecliptic, without reference to the motion which actually brings the moon or the planet from one such phase to the next...*"

(b) "*The synodic arcs for a given phenomenon fluctuate around a mean value $\overline{\Delta\lambda}$ which can be easily determined as soon as a period for the synodic arcs is known. Here it is an essential assumption that the length of the synodic arcs depends only on the longitude where an event takes place. Only under this condition do we know that the synodic arcs repeat themselves exactly as soon as a phase returns to its initial position in the ecliptic. In modern astronomical interpretation this would mean assuming that the positions of the apsidal lines are fixed in the (sidereal) ecliptic, but we have no right to ascribe such concepts to the Babylonian astronomers*"[(41)]

[41] Neugebauer. O. *History of Ancient Mathematical Astronomy*, Vol. II, p.373 New York,

(c) The "Greek-Letter Phenomena"[42]

"The ephemeris, which served us as an example in the preceding discussion is only concerned with longitudes and moments of one specific planetary phase, the so called opposition θ. The rest of the planetary motion, e.g. retrogradations or stretches of invisibility, are of no concern to such an ephemeris. This situation is characteristic for large classes of Babylonian planetary texts. They are concerned solely with one of the phases enumerated here and designated by Greek letters:

Outer Planets	Γ reapperance after invisibility	
	ϕ first station	
	θ opposition	
	ψ second station	
	Ω disappearance	
Inner Planets	Σ reappearance	Evening Star
	ψ first station	
	Ω disappearance	
	Γ reappearance	Morning Star
	ϕ second station	
	Σ disappearance	

The coordinates of these phases provide the skeleton for the computation of intermediate positions of the planet, e.g. by means of interpolatory devices ...This central position of the Greek-letter phenomena is the most characteristic feature of Babylonian planetary theory. Each of the phases is handled as if it were a celestial body of its own-very much reminiscent of the Indian attitude toward the lunar nodes which are put in the same category with the other planets. This approach has the great advantage that each Greek-letter phenomenon progresses with fair regularity in the ecliptic, free from retrogradations of the planet itself.

It is noteworthy that these phases, except for the stations, are horizon phenomena, which is quite in line with the general trend in early astronomy...We have already commented on the deceiving accuracy of numerical data. Similarly deceiving is the inference from large numbers for planetary periods to a great extent of recorded observations. We shall see soon how larger periods were derived from linear combinations of smaller ones, without the use of far distant observations..."

(d) "The astronomical significance of the Greek-letter phenomena lies, of course, in the relation of the Planet to the Sun. Restricting ourselves to mean motions we can say that each accurence of F reproduces the same elongation of the mean planet from the mean sun..."[43]

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[42] Ibid. P.386

[43] Ibid. p.388

These quotations (a), (b), (c) & (d) from O. Neugebauer reflect the major characteristics of Babylonian methodology.

• Similarity between Babylonian and Indian methods

(a) The Hindu approach also had been "arithmetical" in character in the pre-Siddhāntic phase. As Neugebauer has noted we can find many of the Babylonian parameters like 3031 (110 anomalistic revolutions of moon) in Hindu astronomy. Just as the Babylonian listing of the 248 lunar velocities, we have in Kerala the 248 Candravākyas of Vararuci[44] belonging to the pre-Āryabhaṭa period. If we exclude the "Epicycle model" from the Siddhāntic astronomy the rest of the astronomical theory and parameters belong to the pre-Siddhāntic phase that has a striking similarity with the Babylonian science. For eg. The maximum equation of centre for the moon in Siddhāntic astronomy is 301' while the modern value is 377'.3. According to T.S.K. Sastry and Dr. K. V. Sarma[45] the reasons for the decrement is:

"*The Hindu value has been obtained by analysing the times of eclipses, which happen at syzygies. Of the two major inequalities of the Moon, "Variation" vanishes at Syzygies and "Evection" (Maximum value is 76'.5) is reduced to the same form as the equation of the centre with an opposite sign. Thus the value at Syzygies would have a maximum of 301' and this agrees with the Hindu value*".

It is apparent therefore that the Hindu astronomy evolved in much the same way as that of the Babylonian astronomy relying on the observational data on specific events such as new moons, eclipses etc.

(b) The Hindu astronomical computations also make use of the synodic arcs/periods and as shown elsewhere[46] it was the use of synodic periods that led the Hindu astronomers to the concept of a synodic super conjunction at Yugadi. According to Neugebauer (2(b), above), concurrent repetition of the synodic arcs and phases demands the apsides to be stationery but the Babylonians can't be credited with such concepts. As against this observation Hindu astronomy has explicit mention of the stationery character of the apsidal lines since the time of Āryabhaṭa. Obviously, the Siddhāntic astronomy took shape out of Hindu practices very much similar to the so-called 'Mesopotamian' or 'Babylonian' astronomical methods.

(c) Inference 2(d) above, of Neugebauer in the context of "Greek-letter phenomena" also finds its illustration in Hindu astronomy. In view of the computation beginning at the Yugādi synodic super-conjunction, all the computed longitudes of Siddhāntic astronomy are elongations from the sun. In other words sun became the zero in Siddhāntic astronomy as it evolved out of the horizon phenomena, which are dependent upon the elongation of the planet to the Sun.

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[44] Kunhan Raja, C. *Candravākyas of Vararuci.*
[45] T.S.K. Sastry & K. V.Sarma., '*Vākyakaraṇa*' of Sundarāraja. Edited with English translation.
[46] Chandra Hari, K., 'On The Origin of Kaliyugādi Synodic Super-conjunction' IJHS, Vol. 33 (3) 1998, p.193, INSA, New Delhi-2.

(d) Mean motions of the Planets.

We may take Jupiter as an example to illustrate the relationship with Indian astronomy. Neugebauer gives the following data: 391 Synodic revolutions = 36 Sidereal rotations = 427 years. This gives the annual synodic variation in the elongation of Jupiter as 391 x 360 ÷427 = $329^0 38'55''.3$ = 329.6487119. In the Indian traditions, as per Sūryasiddhānta the annual variation in elongation will be = $329^0648333$ = $329^0 38'\ 54''$ while Āryabhaṭīya gives $329^0.648$ = $329^0\ 38'\ 52''.8$. The Indian value is a direct consequence of the assumed super-conjunction at Yugādi. As regards the above 'exact' period, 427 years of Jupiter, Neugebauer gives the following explanation:[47]

"Procedure texts enumerate several different periods of Jupiter, the first two of 12 years and 71 years which are said to require corrections of $+5^0$ and -6^0, respectively, for a return to the same sidereal longitude. Consequently a perfect return should be expected after (6 x 12) + (5 x 71) = 427 years. This shows how two periods which need less than one century of recorded planetary positions, e.g. with respect to fixed stars, were utilized to construct a period which should be "exact" for more than four centuries."

Neugebauer's explanation may not be correct, as the derivation of even much greater "exact periods" did not require observational records of 12 or 71 years. We can find in Indian astronomy method of determination of such exact periods using observations of very short intervals as explained earlier under discussion on Siddhāntic astronomy.

Annual synodic variation of planetary longitude can be expressed as the ratio of the solar year (Y) to the synodic period (S) of the planet. (Y/S) in degrees automatically represents the integral number of synodic revolutions in a smaller Yuga of 360 years.

$(Y/S)^0$ = Integral number of Synodic revolutions in 360 years = n_{360}

$(Y/S)'$ = n_{21600} ; (21600 = 360*60)

$(Y/S)''$ = $n_{1296000}$; (12969000 = 360*60*60). The number of sidereal revolutions (N) could be obtained as, say for example: N_{360} = 360 ! n_{360} or N_{21600} = 21600 ! n_{21600}. With the annual synodic arc of just one year, planetary revolutions of even 1296000 years could be derived arithmetically by the above procedure.

According to Sūryasiddhānta, Jupiter makes 3955780 Synodic revolutions and 364220 Sidereal rotations in 4320000 years. i.e., 197789 synodic and 18211 sidereal revolutions in 216000 years. This gives the sidereal period as = 4332.320575 – very close to the value derivable from 36 sidereal revolns in 427 years (427/36 = 11.86111 years = 4332.374618 if we take the year as 365.25875 days). Aryabhatiya gives 3955776 synodic revolutions in 4320000 years. i.e., 20603 synodic revolutions in 22500 years. Sidereal period = 22500/1897 = 11.86083289 years = 4332.272174 days. That is, Sūryasiddhānta and Āryabhaṭīya respectively gives the synodic periods as 398.8891698 and 398.8894973 days while the Babylonian exact period of 427 years gives the value as 398.8887116 days. The difference between the values of Indian and Babylonian traditions is negligibly small. While Neugebauer is able only to speculate on the possible method of derivation of the Babylonian period, Indian astronomy has preserved a clear-

[47] Neugebauer, O. *History of Ancient Mathematical Astronomy*, Vol. I, p. 391, New York.

cut method in its Yuga conception for arriving at such arithmetical values of synodic periods. Neugebauer has wrongly presumed them as observational values.

Illustration of the Siddhāntic method of derivation of planetary cycles

Example: Jupiter: $(Y/S)^0$ as per Āryabhaṭīya = 0.9156888..(Revolutions) x 360^0 = $329^0.648$ = Synodic revolutions of 360 years. Or 3296.48 = Synodic revolutions of 3600 years. Sidereal revolutions of 3600 years = $3600^r - 3296^r.48 = 303^r.52$. This gives the Jupiter's longitude of 3600 Kali years (elapsed) as = $0^r.52 \times 360^0 = 187^0 12'$. It is apparent from the above that the data required is simply the Jupiter's elongation over a specific solar arc for the computation of the "exact periods". In the above case when sun moves over 360^0 Jupiter's relative movement is $329^0.648$. i.e., when the solar longitude changes by 1^0 the elongation of Jupiter changes $0^0.9156888$ ... Simply with the help of this data, the sexagesimal notation leads us to: $0^0.9156888... = 3296''.48$, and numerically, 3296.48 represent the synodic revolutions of 3600 years as mentioned earlier. This is true about any other planet. Because of this reason only Pañcasiddhāntikā[48] chapter XVIII has the synodic periods expressed in the units of solar days.

It is therefore evident that the Indian method is superior to that of the Babylonians that made use of observational records of 71 years to derive the 'exact' period of 427 years. Further, as can be noted the Babylonian mean motions conform to the concept of, Synodic Super-conjunction of Kaliyugādi ($^{17}/_{18}$ February 3102 BC), which form the crux of

Siddhāntic astronomy as well as the Hindu concept of Time, we find reflected in the Smṛtis, Purāṇas and epics. Will it be prudential to credit the origin of all these to the Babylonian clay tablets of 300 BC? As pointed out by D.Pingree, Is it possible that the Indian astronomers like Āryabhaṭa simply copied the Babylonian mean motions? How could the Babylonian data become the foundation of a new school of astronomy in India, when the Babylonian school itself failed to develop further? More over why the Babylonian records are silent about the rationale of their zodiac and its fixed initial point?

- **Conceptual Superiority of Indian Astronomers**

Contrary to the incompletion and imperfection of the Babylonian system evident in the aforementioned matters, the underlying concepts such as sidereal zodiac, anomalistic revolutions of sun and Moon, stationery apsides, exclusive use of synodic computation (i.e. use of planetary elongations) etc., attains perfection with the Hindu concept of a synodic super-conjuction at Kaliyugadi, anomalistic solar year of 365.25875 days etc. Further, as referred earlier the Babylonian fixed zodiac can only be the Tāntric Mūlādhāra cakra and the concept is purely Indian having mind boggling antiquity of 4137 BC as shown earlier under section III. As compared to the other civilizations of the world, astronomy had more implications with the Indian social life since time immemorial while places like Mesopotamia had no such social compulsion to act as a driving force in the absence of the prevalence of the Vedic/Tāntric tradition. Strong cultural bonds with India

[48] Dr. T.S.K. Sastry and Dr. K. V. Sarma. *Pañcasiddhāntikā*, English translation with critical notes, Pub: PPST Foundation, Adyar, Madras.

only could have inspired the growth of astronomy in Babylon as an offshoot of the original Indian sidereal system of astronomy.

• Evidences of the Cultural contacts with Mesopotamia

1. Vedic Gods in Mesopotamia

Cambridge 'History of India' Vol.I refers to the discovery of an inscription of Boghoz Koi, which gives the peace treaty between the king of Hittites and the king of Mitani that took place around 1400 BC in Asia Minor. This treaty contained the names of the Vedic deities Mitra, Varuṇa, Indra and Nāsatyas as the Mitani gods. H.Jacobi has expressed the following views on this discovery:

"...these five gods not only occur in the Ṛgveda, but they are grouped together here precisely as we find them grouped in the Veda. In my opinion, this fact establishes the Vedic character and origin of these Mitanni gods beyond reasonable doubt. It appears therefore quite clearly that in the fourteenth century BC and earlier the rulers of Northern Mesopotamia worshipped Vedic gods"[49]

2. Two of the verses from the Gītā pertaining to rebirth have been found inscribed over an Egyptian pyramid dated to 3000 BC.[50]

3. The worship of the Liṅga, Bull and Serpent have all prevailed in Mesopotamia from very ancient times and are suggestive of Dravidian / South Indian / Tāntric influence. As described earlier the above deities had an astronomical origin in the pre-historic past under an Indian paradigm of abstract symbolism and thought. The serpent worship extant in India in its pristine sanctity at the Maṇṇāraśāla Śṛī Nāgarāja temple of Kerala depicts the deity as Liṅga adorned with the serpent ('nāga veṣṭita liṅga') and truly reflects the cardinal astronomical feature (as far as the Tāntric cult is concerned) of the epoch of 4137 BC.

4. Worship of the mountain god and goddess, Mother Goddess etc., also had an astronomical origin at the above Tāntric epoch. As explained before the Phallus or more generally the genitals represented on the 'human-zodiac' the position of the fiducial star Mūla and thus became symbolically representative of time i.e., Mahākāla and Mahakāli, the Father and Mother goddess of Time. The related Indian legends depict the astronomical origin in symbolic language. In 4137 BC, the solstices marked the initial points of the female signs Mīnā and Kanyā. In the symbolic language the maximum declination of the sun made these points the mountains and the sign Mīnā (Pisces-fishes) appeared in mythology as the "Adrikā" (an Apsara; etymology of the term 'adri' suggests mountain's daughter) who in turn took birth as a "Matsya-Kanyā" in the Matsya country. The word 'Matsya-Kanyā' in fact is a cryptic reference to the zodiacal signs of Mīnā

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[49] Jacobi, H.G. On the Antiquity of Vedic Culture, Journal of the Royal Astronomical Society, July 1909, pp.721-26

[50] Choudhary Paramesh has quoted Voltaire in his book –*The Aryan Hoax That Dupes the Indians*, p.97, 1995, Calcutta.

(Matsya) and Kanyā (Virgin). Similarly, we have the legends of "Pārvati" (note the similarity to 'Adrika') who is taken in mythology as the daughter of Himavat - Haimavati, the mountain here represents the solstice of winter. Worship of the 'Fish' god also finds an explanation in the above details. To understand the true significance of these inferences we must examine them in the light of the following words of Voltaire written in 1775 to Jean Bailly:

"*I whole-heartedly support your view that it is not possible for different peoples to have shared the same methods, the same knowledge, the same legends, the same superstitions. This could only happen when these had been adopted by a primitive nation, which taught, and led astray, the rest of the world. Now I have long since regarded the dynasty of the Brahmins as having been this primitive nation. You must be familiar with the books of Mr.Holwell and Mr.Dow...Finally, Sir, I am convinced that everything has come down to us from the banks of the Ganges, astronomy, astrology, metempsychosis,* etc." [51]

5. Atharvaveda V.13.6 -10 speaks of 'Taimata', which according to Tilak is of Chaldean origin. Tiamat is the Chaldean dragon of chaos in possession of the Tablets of Fate. These instances of commonality of Gods in distant antiquity point towards significant cultural contacts and exchange of wisdom with the Mesopotamian people.

6.Scholars have found many correlation between Indian Dravidian /Sanskrit as well as Sumerian terms. As for example the Sumerian word, for star is "Mul" which has a striking resemblance to 'Mūla', the name of the Indian fiducial star and in Mesopotamia the word 'Sindhu' means cotton – obviously as a product coming from India. The following opinions from reputed scholars are noteworthy in this context.

- **Francois Lenormant**: [52]

"It is by no means improbable, that the Sumerians were an Indian race, which passed by land and sea, into the valley of the Two Rivers. It was in their Indian home, perhaps in the Indus Valley, that their culture developed"

- **Sir John Marshall**:[53]

"If, therefore, these scholars who consider the Sumerians to have been an intrusive element in Mesopotamia, then the possibility is clearly suggested of India proving ultimately to be the cradle of their civilization, which in its turn lay at the root of Babylonia, Assyrian and Western Asiatic culture generally".

7. Dependence of the Sumerian script on the Indus script

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[51] Choudhary Paramesh has quoted Voltaire in his book –*The Aryan Hoax That Dupes the Indians*, p.97, 1995, Calcutta.

[52] Lenormant Francois. *Bengal Magazine*, Vol.6, January 1878, p.530

[53] Marshall, Sir John. Annual Report of the Archaeological Survey of India, 1923-1924, p.50

Heras, S.J:[54]

"...this relation between both scripts, and especially the account of Berossus, show that India was the cradle of the Sumerians. They came by sea, and the shores of India inhabited by Dravidian people seem to have been the starting point of Uvanna, Odakon and other leaders – the ancestors of Mes-annipada, A-ani-padda, Mes-Kalam-dug and others, whose name are not less Dravidian."

Prof.Langdon:[55]

After a detailed study of the Mohenjo-daro and the Sumerian signs, Prof.Langdon has acknowledged the fact that one of the two scripts was the development of the other, and that the Mohenjo-daro script appears older than the Sumerian. Even he endeavored to show that the pictographs found in Mohenjo-daro, were the original signs out of which the Sumerian signs developed and the link between the two scripts can be found in the Kish tablet of the Ashmolean Museum.

8. Linguistic Evidence

Scholars have found the use of many Sanskrit and Tamil words in the Sumerian language. One of the most notable is, 'Ur' which means a settlement or town, is widely under use in south India. Similar is the common use of the term 'Min' to represent the fish as well as the star. Fish forms a major character of Sumerian mythology and was the patron-god of Ninevah - the capital of an Assur kingdom, identified by some scholars as the Śōṇitapura of Mahābali and Bāṇa. According to Sumerian legends, it was the fishes (tribe of the Minas) that brought civilization to their land and their heroes were Oannes and Odakon equipped with agriculture, metallurgy and the art of writing. Pictographs of fish have been found in large numbers at both Mesopotamia and the Indus civilization. The south-Indian connection is also apparent in the use of 'Min' and if the conjecture about Ninevah is reasonably correct, the traditional belief in Kerala about Mahābali assumes significance. As explained earlier, Mahābali in mythology was the 'guardian Asura' of a sidereal solar calendar that began with the sign 'Mīnā' and he was send to Pātāḷa (netherworld) by Viṣṇu. A little of history may be conjectured from the astro-mythological legend that after the exit of Mahābali, his son Bana might have left India for the middle east with his followers and established a kingdom there-in under the same name. The fact that Bāṇa's capital was guarded by Rudra-Śiva is reflective of the Tāntric character of the society.

9. Mediterranean origin of the Dravidian people

S.K.Chatterjee gives the following account in 'Vedic Age':[56]

"*From various aspects, a Mediterranean origin of the Dravidian people, its origin and*

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[54] Heras, S.J. History of the Indo-European Races

[55] Langdon, Prof. *Pictographic Inscriptions from Jemdet Nasr*, p.iv & viii.

[56] Chatterjee, S.K. *The Vedic Age*, p.160, Bharatiya Vidyabhavan, Mumbai-7. (1996)

civilization, appears to find good support. Reference may be made in this connection to the city culture of Harappa and the ancient cities of Sind described in the next chapter. On the positive side, the cult of Siva and the institution of yoga appear to have been characteristic of the religious life...the Dravidians appear to have brought to India from their original home land in the islands of the Aegean and the tracts of mainland along the Aegean Sea – Greece and Asia Minor."

In the light of the link established between Jyotiṣa, Yoga and Rudra in the present paper the cult of Śiva and Yoga could have originated only in India[Ψ]. So the features that S.K.Chatterjee found as reflective of a Mediterranean origin of the Dravidian people is in fact, supportive of an Indian invasion of the Aegean islands and Asia Minor.

- **Conclusions**

Astronomical interpretation of the Tāntric concept of Mūlādhāraṃ and the Iconography of Śiva suggested the possibility of a Calendar-epoch having the Sun, Moon and the autumnal equinox associated with the fiducial star Mūla occupying 240^0 of the Sidereal zodiac. Search using a modern computational program could locate this epoch as on 23 October 4137 BC. Further, at this epoch the lunar nodes Rāhu & Śikhi also occupied the center stage along the Celestial Ganges in association with the 'path of the manes' that leads to the hell. This configuration explained the Hindu notion of Kālasarpa as well as the interpretation of Rā-śi cakra as 'Rāhu - Śikhi Cakra'. Moreover, the epoch and the zodiac reflected the astronomical rationale of Phallus and Serpent worship and point towards the existence of a well-developed school of astronomy among the Tāntric cum Vedic tradition of ancient India. The antiquity established lies much beyond the epoch of Vedāṅga Jyotiṣa and the astronomical traditions that prevailed elsewhere in the world. Further, the above epoch was sandwiched between two other calendar beginnings, which were also reflective of certain mythological episodes. Analysis given provides confirmation to the fact that the Hindu epics and Purāṇas had their origin over the zodiacal events in the context of Calendar practices. These three epochs taken together render explanation/rationale for many of the present day Hindu observances as well. It is conclusively established that the zodiacal formalism had its origin in the Tāntric cum Vedic tradition of India in pre-historic times. The astronomical rationale of Mūlādhāraṃ, the synonymous phraseology reflective of the inter-dependence of Yoga (Tāntra) and Jyotiṣa, and the mythology associated with Mūla having deep roots into the Indian culture leaves no doubt as regards the origin of Yoga and Jyotiṣa in ancient India.

[Ψ] The fact that Jyotiṣa (astronomy & astrology) and Yoga had a simultaneous, common origin is evident from the synonymous phraseology of the two disciplines: In Yoga, "Mūlādhāraṃ" is the source of Kuṇḍalini śakti while in Jyotiṣa Mūlādhāraṃ is the 'source' or the basis of Kuṇḍalini - the horoscope. Both disciplines have yogas, Ida, Piṅgala and other nādis, Śiva and Śakti of Yoga have the parallel of Sun and Moon in Jyotiṣa and according to mythology it was Śiva who enunciated the disciplines to Śakti for the first time. Moreover the time factor was very important in the realization of Tāntric objectives and without a long civilizational history it was impossible for the two sciences to emerge spontaneously in a location. The roots or remnants of such a development is not available in any other country than India.

It is true that the planetary elements and the pre-Siddhāntic computational methods are reminiscent of the Babylonian astronomy of the Seleucid period around 300 BC. This has led the scholars to a general notion of Babylonian origin for astronomy. However, if we go a bit deeper into the antiquity it can be realized that not only astronomy but also the sexagesimal notation was prevalent in India thousands of years earlier. Undoubtedly the most fundamental of the Babylonian concepts viz., Sidereal fixed zodiac and the 30 divisions of the mean lunation viz., tithi are of Indian origin. In support of this inference, a number of successive Vedic astronomical epochs have been identified and dated – Ṛkjyotiṣa suggests the epoch of BC 2423 while certain other astronomical references in the Vedic literature can be dated as BC 1942, BC 1702 and BC 1448 respectively. All these point towards the origin of sidereal zodiac and astronomy in mind-boggling antiquity under the Vedic/Tāntric tradition of India. An exclusive discussion on the astronomical aspects of Hindu mythology do not fall within the scope of this paper and the present author will be elaborating this aspect in due course of time.

If the division of the circumference of a circle into 60 parts by Eratosthenes around 250 BC could testify the prevalence of Sexagesimal notation among the Greeks, then undoubtedly the credit of original invention of not only sexagesimal system, but the whole of arithmetic must go to the Vedic civilization.

• The rejection letter had the following observations:

"I have seen the revised version of your paper and also its two earlier versions together with the reports of the referee. I uphold referee's reservations about Natwar Jha's decipherment of Harappan Script and V. Holay's interpretation of Vedanga Jyotisa, which your revision doesnot wish to address. Moreover, the main postulates of your theory of the remote antiquity of 4137 BC have already been published in several papers in this journal. The present paper is on the whole an elaboration of your theory, but it adds to the methodological problematique of forcing every strand of culture to fit into one single notion. In these circumstances, it will not be possible for us to accept your paper for publication".

In a paper running over 50 pages there was only a casual reference to Jha's decipherment and Holay's interpretation of Vedāṅga Jyotiṣa. A paper that was revised twice as the referees found it worthy of publication after certain modifications, which I have complied with, was finally rejected on aesthetic considerations. Reproduced below is another paper which shared the same fate.

• Kṛttikās, Great Bear and the Antiquity of Vedic Astronomy

Introduction

Studies on the antiquity and depth of ancient Indian astronomy vis-à-vis dating the Vedas based on the astronomical references have been characterized by two distinct trends during the last two centuries of historical research. The first category include those which projected a deeper antiquity and substance – like those of Jacobi, Tilak, Dikshit, Shyāmaśāstri – while the second contained grounds that demanded a reduction of the antiquity and a Greco-Babylonian origin from scholars like Whitney, Keith, Pingree etc.

The trend is continuing among present day scholars as can be understood from a recent volume of IJHS [57] and Electronic Journal of Vedic Studies [58], where we can meet with a reexamination of the dating of the Kṛttikādi epoch by Prof. N. Achar and a criticism of the same by the editor of the journal M.Witzel. Achar begins by presenting the views of Dikshit and its conflict with that of Pingree and goes on to date (2927 BC) with modern computer software the Śatapathabrāhmaṇa statement that the Kṛttikas never swerve from the east. According to Pingree, not only Kṛttikās but Hastā, Viśākhā, and Śṛāvaṇa were also on the equator along with Kṛttikās in 3000 BC and as such the Dikshit's interpretation that 'Kṛttikās rose exactly on the east or the Kṛttikās had the equinoctial colure' is not a valid inference. Similarly, about Achar's dating M.Witzel has expressed the following observations:

"While the ZB (Śatapathabrāhmaṇa) quotation discussed by N.Achar and his predecessors indeed seems to point a situation where Kṛttikā nakṣatra was situated at true east at the equinox, i.e. in 2927 BCE. However, the exact wording of the sentence just indicates that the Kṛttikās do not move away (na cyavante) from the east. The Pleiades, just like any other naksạtra close to the ecliptic, do of course rise in the east (during the course of one night or of the year), move upwards towards the south and set in the west. However, the Pleiades, even when the gradual changes effected by are taken into account, move very little indeed from the eastern direction over many centuries after the above date. This is important. From 2900 to c.1500, a period framing the whole of the Indus civilization, (2600 – 1900, thus with a margin of a few centuries before and after it), and even from 1500 – 500 (the usual date of the Vedic period), the Kṛttikās indeed were situated close to the equator (see below). We should not, as is always done, compare the (pre-) Vedic situation of 2900 BCE with today's, instead we must investigate the difference between the starting point of this system at c.2900 BCE, in the early copper/bronze age, [6] with that of ZB, which is, after all, an iron age text. The Iron Age starts in India at c.1200 BCE at the earliest, but the general linguistic, spiritual, social and political developments of the ZB points to a time frame shortly before the lifetime of the Buddha (around the middle of the millennium, traditionally 563 – 483 BCE, or even only around 400 BCE).... On checking with similar astronomical software (Voyager II), we observe that during the years from 3000 BCE down to 500 BCE, i.e. close to the approximate date of ZB, the Pleiades move very little from the eastern direction at their position at Spring Full Moon. At vernal equinox in 2900 BCE the Kṛttikās were at 90 Azimuth, i.e. due east according to Achar, while at 1527 BCE they were at 81:43, at 1027 BCE at 74:47, and at 500 BCE at 77:38. These data were calculated for the Pleiades star Maia on Full Moon day; to day they are off from the point of the vernal equinox (near lambda Piscis, phi Aquarii) by some 5423; that mean they are seen in the northeast.

The 'traditional' Vedic situation, thus holds out for long enough that ZB still can speak of the Pleiades as 'rising in the east' – may not true east, but 'east enough' at some 8-13 off true east. It must be underlined that the text actually does not speak of 'true east', - that is only Sāyana's interpretation (14thc. CE) i.e., of someone living just some 500 years before our own times". (sic).

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[57] Achar, N., "On the astronomical basis of the date of Śatapathabrāhmaṇa", *Indian Journal of History of Science*, Vol.35 (1), March 2000, p.1-10

[58] Achar, N. *Electronic Journal of Vedic Studies*, Available on the Internet

Witzel's observations are apparently quite genuine and it will be considered as overzealous if we attempt to project an antiquity of 3000 BC for the above reference to Kṛttikā in Śatapathabrāhmaṇa. Further, we must note that Achar himself and his predecessors like Dikshit [(59)] were also equally aware of the astronomical factors raised by Witzel, but they chose to ignore them as against the emphasis by Witzel. In historical research, this emphasis plays a major role in distorting the true state of affairs – simply by shifting the emphasis or by limiting the purview alternate hypotheses can be developed. Dikshit emphasized the 'true east' taking into account the ritualistic, linguistic and chronological connections between the Vedas and Brāhmaṇas while Witzel chose to ignore 'true east' as "interpretation of someone living just some 500 years before our own times" to suit his conception of the Vedic period as between 1500 – 500 BC. While drafting out his editorial comments he did not bother to look for similar references available elsewhere in the Vedic literature that may throw some light on the Kṛttikādi epoch.

We can find similar situations/interpretational conflicts on the question of intercalations in Vedic calendar and as regards the observation of planets in Vedic antiquity. If we combine the views of Keith [(60)] (that the planets were not known to Vedic Hindus and there are only traces of a tendency to intercalate a month every fifth or sixth year) with the generally accepted antiquity 1500 – 500 BC, many of the Vedic astronomical references which contradict this bracket have to be credited to a "pre-Ṛgvedic lore" (in the words of Witzel), while the references that do not suggest a specific epoch like those related to calendar and intercalation must belong to the post-Buddha period.

In the above situation, we find Achar and Dikshit, advocating an antiquity of 3000 BC, pitted against Pingree and Witzel - research over research adding more and more confusion as regards Vedic antiquity despite the efforts of last two hundred years. Present paper is an attempt to counteract the obliteration of real facts taking place as a result of the mutually contradictory theses coming out of historical research.

Kṛttikā Pūrṇimā in Vāyupurāṇa

Apart from Śathapathabrāhmaṇa II.1.2, which has led to the above speculation as regards the date, we can find a more explicit and unambiguous reference about the Kṛttikā epoch in the Vāyupurāṇa Chapter 53:[(61)]

Vivasvānaditeḥ putraḥ sūryovaicākṣuṣe tare I
Viśākhāsu samutpannaḥ grahāṇaṃ prathamograhaḥ II 104 II
Tviṣiman dharmaputrastu somo viśvavasustathā I
Śāntharaśmiḥ samutpannaḥ Kṛttikāsu niśākaraḥ II 105 II
Ṣodaśārcibhṛgoḥ putraḥ śukraḥ sūryādanantaraṃ I
Tāragrahāṇām pravaraḥ tiṣyakṣetre samutthitaḥ II 106 II
Grahścāṅgirasaḥ putrodvādaśācirbṛhaspatiḥ I

[59] Dikshit, S.B. "The Age of the Śatapathabrāhmaṇa", Indian Antiquary, 1895, 24, p.245
[60] Keith, Survey of studies in Europen Languages, p.90, IJHS, 20, 1985
[61] Daftari, K.L., 'The Astronomical Method and its Application to the Chronology of Ancient India', University Office, Nagpur

Phalgunīṣu samutpannaḥ sarvāsu ca jagadguruḥ II 107 II
Navācirlohitāṅgastu prajāpatisutograhaḥ I
Āṣāḍhāsvihā pūrvāsu samutpanna iti śrutiḥ II 108 II
Revatīṣveva saptacirsthatā sauraḥ śanaicaraḥ I
Revatīṣu samutpannou grahou candrārkamardanou II 109 II

Translation of verses 104 – 109:[62]

• 104:"Vivasvān, the son of Aditi, the first among the planets, i.e., the Sun-god, was born under the constellation Viśākhā in the Cākṣuṣa Manvantara".

• 105: "The brilliant Moon-god Viśvāvasu, the son of Dharma, the cool-rayed maker of nights, was born under (the constellation) Kṛttikā".

• 106: "After the Sun, śukra (Venus), son of Bhṛgu, endowed with sixteen rays, who is next to the Sun is the most excellent among constellations and planets. He is born in the constellation Tiṣya (Puṣya)/ Nisṭyā (Svāti)".

• 107:"The planet Bṛhaspati (Jupiter) of twelve fiery flames, who is the son of Aṅgiras and the preceptor of the Universe was born under the constellation Phālguni.

• 108: "It is reported that the nine-rayed, red-bodied planet (Mars), son of Prajāpati, is born under the constellation Pūrvāṣāḍhā".

• 109:" The seven rayed planet, Saturn, son of the Sun, is born under the constellation Revatī. The planets harassing the Sun and Moon are born under the constellation Rohinī" (Daftari has accepted the reading Revatīṣu instead of Rohiṇīṣu in the last line).

These verses imply that at the epoch of Cākṣuṣa Manu, the planets were born in the following nakṣatras: Sun: Viśākha, Moon: Kṛttikā, Venus: Tiṣya? (Perhaps Niṣṭyā), Jupiter: Phālguni, Mars: Pūrvāṣāḍhā, Saturn: Revati and Rāhu: Revatī. Daftari could compute the epoch from these positions and the relevant data as per the latest astronomical algorithms are as follows:[#]

[62] Tagare, G.V., The Vāyupurāṇa Part-1, pp. 370-371, Motilal Banarsidass, Delhi, 1987.
[#] Here the nakṣatra/sidereal positions have been calculated by taking Mūla as fiducial, with a fixed (sidereal) longitude of 240^0. Over this sidereal zodiac or Mūlādhāra Cakra, the above epoch had an ayanāṃśa of 36^{0}35'.

Cākṣuṣa Epoch: 8 October 2422 BC, Full moon at 1302 IST, Tuesday, JD: *837067.813646*

Planet	Longitudes		Nakṣatra
	Tropical	Sidereal	
Sun	$175^0 31'$	$212^0 06'$	Viśākhā
Moon	$356^0 40'$	$31^0 5'$	Kṛttikā
Mars	$223^0 45'$	$260^0 20'$	P.Āṣāḍhā
Mercury	$196^0 48'$	$233^0 23'$	Jyeṣṭhā
Jupiter	$114^0 38$	$151^0 13'$	U.Phālguni
Venus	$152^0 21'$	$188^0 56'$	Svāti (Niṣṭyā)
Saturn	$321^0 46$	$358^0 21'$	Revatī
Rāhu	$303^0 29'$	$340^0 04'$	U.Bhadra

These positions are in remarkable agreement with the verses cited above. It must be noted that even the position of Rāhu (stated as in Revatī but actually it is in U.Bhadra) could be ascertained in 2422 BC with considerable accuracy. The position of Venus is not that clear from the verse and we may take it as Niṣṭyā the synonym of Svāti instead of Tiṣya. Another remarkable aspect is that moon had a northern latitude of $04^0 06'$ and rose on that day in rapt conjunction with Kṛttikā (Alcyone: $35^0 24'$, Latitude:$04^0 03'$) at 18:19 IST on 30^0 N with the longitude of $35^0 54'$ and latitude $04^0 14'$. It is therefore apparent that the rising moon had occulted Alcyone (η-Tauri) and the epochal observation was recorded meticulously along with the positions of other planets.

Visibility of the occultation in North India – New Delhi

Visibility of the occultation to an observer depends on the relative positions of the Moon's shadow cast by the starlight onto the Earth and the observer. As the computation of the actual circumstances of an occultation is laborious planetarium software was used to ascertain the visibility. The relevant astronomical details are:

Epoch: 8 October 2422 BC. Moonrise: 1756 LMT.

Right Ascension of moon: $23^h 50^m 39^s$; Declination: $02^0 44' 48''$.
Azimuth: $86^0 24' 38''$; Altitude: - $00^0 13' 27''$.
Longitude: $358^0 26'$; Latitude:+ $04^0 11'$.

Right Ascension and Declination of Kṛttikās

Star	RA: h-m-s	Decln.	Azimuth	Altitude
Alcyone	23-49-58	$2^0$50'49"	$86^0$24'11"	- $0^0$03'39"
Merope	23-49-02	$2^0$39'23"	$88^0$21'33"	$2^0$47'36"
Electra	23-47-37	$2^0$44'35"	$88^0$27'09"	$3^0$07'42"
Taygeta	23-47-39	$3^0$07'09"	$88^0$07'07"	$3^0$17'41"
Maia	23-48-17	$3^0$02'19"	$88^0$06'49"	$3^0$07'29"
Atlas	23-51-30	$2^0$52'21"	$94^0$15'41"	$13^0$47'22"
Pleione	23-51-28	$2^0$57'03"	$94^0$11'44"	$13^0$50'07"

The software animation depicts the moonrise at the middle of occultation of Kṛttikās and reappearance of the stars at: Alcyone: 1810LMT; Atlas: 1659LMT and Pleione: 1900 LMT. As the Sunset occurred at 1807 LMT, the phenomenon could not be visible due to evening twilight: Civil: 1831(LMT); Nautical: 1858(LMT); Astronomical: 1926 (LMT). That is, according to the modern algorithms the ancient observers could have only conjectured the occultation, could not have viewed it. As such the purāṇic reference needs to be interpreted as a record of only the Kṛttikā-pūrṇimā happening in the vicinity of autumnal equinox and not that of an occultation.

- **Secular variation in the deceleration of earth's rotation**

Alternatively, if we assume that the full moon received special attention and got recorded by the ancient people because of the occultation of Alcyone, it means that the presently accepted rate of earth's rotation may not be very exact for the antiquities like 2422 BC. In other words, a refinement in the present theories of earth's rotation may make the above occultation visible beyond the twilight hours at New Delhi or its neighborhood - Northern India.

The Civil Time is based on the rotation of the Earth, the deceleration of which is irregular and the rate of rotation now under use in modern algorithms is based on the medieval and ancient observations of solar eclipses. Accordingly at the above epoch of 2422 BC, $\delta T = TT - UT = 0.768$ days ($66371^s.8$) and therefore UT is early by 18 hours 26 minutes. This estimate is based on the Babylonian observations of solar eclipses which dates back roughly to the antiquity of only 1200 – 1300 BC maximum and obviously the **δT** value for 2422 BC is only a rough estimate. As such if the above occultation is made to be visible in northern India by appropriate modification in the software/modern algorithm for earth's speed of rotation, the same may represent the antiquity of 2400 BC better than the presently accepted equation based on the Babylonian solar eclipses.

In fact, we can find a similar argument in Nature, Vol. 338 –16 March 1989: Author has re-dated a Babylonian eclipse of 03rd May 1375 BC to 5th March 1223 BC and has drawn the inference: "This new date implies that the secular deceleration of the earth's rotation has changed very little during the past 3000 years". Here the situation and conclusion are different, the ancient record suggests that the secular deceleration of earth's rotation had a bit of unanticipated change during the interval of 1200 to 2400 BC and the modern

algorithms representing the earth's rotation are in need of a slight revision for antiquities such as 2400 BC.

Visibility of occultation in full-moon light

Referee has rightly pointed out the difficulty of observing the occultation on a full-moon night in the following words:

"When the moon is full the sky is so bright in its vicinity that it is not possible to see the stars close to it with the naked eye. So the occultation of Kṛttikās by the moon could not have been observed if it took place at a convenient time. But an occultation inferred from the observations of the moon before and after the full moon day would also draw attention of astronomers. What is important is the precise configuration of the planets that was noted at that time. This aspect should be emphasized instead of appealing to the variation of earth's rotation".

I beg to differ from the above viewpoint a little on the following grounds: Verse 105 has recorded the observation that the Moon-god is born on Kṛttikā and it is quite unlikely that such a statement is based on an inference based on observation of successive days rather than an observation. In a full-moon night the disappearance at the bright Limb may not be visible but when an observer looks at the star and the moon as the longitudinal separation decreases, at a certain moment the light of the star melts into the bright light of the moon. As far as the observer is concerned the phenomenon he observes is an occultation. Similarly an observer could have witnessed the reappearance of the stars of Kṛttikā out of the brightness of the moon. *Unless linked by a specific observation to the stars of Kṛttikās, the ancient observers would not have imagined the birth of moon-god over the Kṛttikās.*

Occultation of Alcyone in fact is not an isolated astronomical phenomenon. For the stars like Alcyone lying at an ecliptic latitude of $+04^{0}03'$, the occultation occur in series over long durations like six years. Last occultation series of Alcyone had been from 30 July 1986 to 10 March 1992 – a total of 76 occultations. The series started with occultations visible in southern hemisphere but from January 1987 onwards the occultations were visible from the northern hemisphere. The last occultations of 1992 had their visibility shifted to the southern hemisphere. We had a similar situation in 2422 BC. A series of occultations of Alcyone by moon beginning with the above might have been under observation during the above period. Position of the node had been favorable since the middle of 2423 BC, but the first of the visible occultations happened only on 14.08.2422 BC or perhaps due to earth's rotational effects only on 8.10.2422 BC. This precisely may be the factor that inspired the ancient observer to keep a record of the observations of sun, moon and planets. In the light of this evidence there are no reasons to suspect the establishment of nakṣatra divisions and well developed planetary observations in India in Vedic times as early as 2422 BC. Is there any ambiguity in the purāṇic description of the epoch of Cākṣuṣa Manu that necessitates an accreditation to the pre-Ṛgvedic lore? We have no reason to doubt the Vedic character of the epoch, Cākṣuṣa being a very popular Manu of Purānic/ Vedic antiquity.

Vedic Identity of Cākṣuṣa Manu

Referee has desired that if Cākṣuṣa Manu has Vedic identity it should be corroborated with a quotation from the Vedas. Present author could not meet with this demand, as no such reference could be located in the Vedas. Vedic Index[63] also do not mention about Cākṣuṣa Manu specifically. But there are references to Vaivasvata and Sāvarṇi Manus in the Vedas according to the Vedic Index. *In my view the fact that Cākṣuṣa is referred to as a Manu is sufficient to establish his Vedic identity.* After all by no stretch of imagination can we consider the Vedas as an exhaustive 'Who's Who" of the Vedic period. Further, K.L.Daftari – a scholar of no mean repute – had discussed the above dating in his fourth lecture entitled "The Chronology of Pre-Mouryan History or The **Date of the Vedas**" given at Nagpur University in the year 1940. Vāyupurāṇa may not be a part of the Vedic literature as the referee has pointed out but it is a text on Vedic history and Indian antiquity as shown by Late. Sri. K.L. Daftari.

Further, corroborative evidence that substantiates the Vedic character of the above astronomical epoch is available from Vedāṅga Jyotiṣa.

Evidence of Ṛk Jyotiṣa – Winter Solstice Coinciding With Māgha Pūrṇimā

Ṛk-jyotiṣa verse 5:

Svarārkameke somoƒrkaḥ yadā sārkaḥsavāsou I
Syāttadādi yugaṃ māghastapaḥ śuklodinantyajaḥ II5II

"Yuga, the sidereal month Māgha as well as the tropical month Tapah have their beginning at winter solstice at the end of śukḷapakṣa when moon conjoins Maghā with sun at the east end of śraviṣṭhā division".

As shown by Holay[64], this verse is suggestive of the coincidence of winter solstice with the full moon on Maghā when the sun is at the east - end of the Śṛaviṣṭhā division. On the basis of the sidereal stellar zodiac beginning with Aśvini, the above epoch of Ṛk-jyotiṣa corresponds to the fall of solstice across $306^{0}40'$ – $126^{0}40'$ in / around 2435 BC. As against this estimate of the antiquity of Vedāṅga Jyotiṣa, the earlier interpretations and dating of the epoch was around 1350 BC.

O.Neugebauer has expressed certain reservations regarding the efforts by modern astronomers to examine the observational basis of ancient references in the light of modern astronomical accurate computations. Such reservations may have some significance in the context of Babylonian arithmetical schemes, which do not suggest a specific epoch. But that is not the case here as the astronomical phenomenon referred above i.e. full-moon over laying the solstitial line across $306^{\circ}.666$ -$126^{\circ}.666$, had a clear "observational identity" in the acronycal rising of Maghā (Regulus) or α-Leonis having a sidereal longitude of $125^{\circ}14'$. Acronycal rising of Regulus heralded the impending solstice

[63] Macdonell, A.A., and Keith, A.B., Vedic Index of Names and Subjects, Vol.2, MLB, Delhi.
[64] Holay, P.V., *Vedic Astronomy*, (Vedāṅga jyotiṣa), Nagpur

on the next day and the full moon had a rapt conjunction with Regulus placed over the ecliptic. With the help of this "observational identity" the epoch can be precisely determined as: UT (-) 2423 (or 2424BC) January 08, 11:03. JD = 836064.96042, Sunday.* On the evening of 7th January at the Indian longitude of Ujjain, moon rose in conjunction with Regulus and heralded the beginning of the Yuga next day.

This Ṛkjyotiṣa epoch of 2424 BC is very close to the Cākṣuṣa epoch of 2422 BC mentioned earlier. But the Cākṣuṣa epoch is Kṛttikā-pūrṇimā falling near to the autumnal equinox while the Lagadha epoch of Ṛkjyotiṣa is Maghā-pūrṇimā coinciding with winter solstice. Unfortunately, we have no information about planets in the latter record and so it is generally accepted that planetary observations did not form a part of Vedāṅga Jyotiṣa. The two records placed together, lead us to a valid inference that the extant version of Vedāṅga Jyotiṣā is not a complete account of the astronomy of the ancient period. Further, Cākṣuṣa epoch and the planetary record provide an indirect substantiation to Holay's determination of the antiquity of Vedāṅga Jyotiṣa to be around 2400 BC.

The missing planetary data of the subsequent period shall obviously be a major source of confusion while attempting to take stock of the depths of Vedic astronomy; but the lone planetary record from Vāyupurāṇa cannot be ignored on the grounds that it may be a later addition or borrowed from an unknown pre-Vedic source.

Evidence of Seven Sages (Saptarṣis) or the Great Bear

(1) Witzel's Account

Witzel in another remarkable paper "Looking for the Heavenly Casket" has summarized the various findings on the stellar configuration consisting of the Saptarṣis and the polestar, with the identification of the polestar as Polaris or α-Ursae Minoris of sidereal longitude $63^0 59'$ and latitude $66^0 06'$, which had been close to the pole since BC 500 according to Witzel. (In fact, the closest approach to the pole occurs only in 2100 AD). The following extracts from the above paper are noteworthy:

(a) Ancient people were well aware, of course, that the stars, just like the sun and the moon, rise in the east and set in the west. However, they also knew that if one looks northwards, towards the region where the polestar (Polaris) is seen now[65] *all stars close to it turn around Polaris in counterclockwise fashion...*

(b) In this upward region of the night sky another strange feature can be found - at least, in mythology. Kuiper pointed out some 20 years ago that Varuṇa as well as some other gods turn over or tip over a heavenly vessel, a casket or bucket (kosa) and empty its contents over the earth down beneath it, as can be seen in passages like the following. RV 5.85.3 "Varuṇa has poured out the cask, with its rim turned downwards, over heaven, earth and the interspace. Thereby the king of the whole world sprinkles the soil, as the

*Tropical sun = 270^0, moon = 101^0 16' 23". Precession relative to Mūla as fiducialat 240^0 (Ayanāṃśa) = $36^0 37'$. Sidereal positions: sun = 306^0 37', moon = 137^0 54', Tithi: 16th (Kṛṣṇa 1)

[65] Where it could be found, due to precession, since c. 500 B.C.E

rain (sprinkles) the barley."[66] *RV.8.72.8 "With the ten (fingers) of Vivasvat, Indra has pulled up the heavenly bucket, with a threefold cord."*[67] *RV 8.72.10 "They (the hotrs) pour out with obeisance the inexhaustible source that goes round (?) with its bottom upwards (and) its rim downwards".*

(c) However, another possibility, which I did not take into account at the time is the actual highest, but unmovable point in the night sky, the region near the polestar or the polestar itself. As is well known, the star Polaris became our polestar only by c. 500 B.C.E. Before this time, the location of the pole was between three other stars in that region (since the beginning of the second millennium B.C.E.)

(d) If one then were to try to find the heavenly casket in the nighttime sky, one cannot immediately discover, in the direct vicinity of the pole star anything, which looks like a casket or a bucket. What then, could be this apparently "invisible" vessel? Some texts of the AV and of the Upanisads provide the key for an understanding. AV 10.8.9 (17) runs as follows:

" A bowl (camasa) with orifice downwards, bottom-side up - in it is deposited glory of all forms; there sit together the seven seers, who have become the keepers of it, the great one" ...

(e) There is an even clearer version of this AV verse in BAUK 2.2.4 (SB 14.5.2.4):

"There is a cup with its mouth below and its bottom up. In it is placed every form of glory. On its rim [tire] sit seven seers. Voice as an eighth is united with prayer (brahman)." [tr. Hume]

The "commentary" that is given by the author of the Upaniṣad on this passage is still more enlightnening as it even identifies the very Ṛṣis:

"On its rim sit seven seers ... these two are Gotama and Bharadvāja, ... Viśvāmitra and Jamadagni, ... Vasiṣṭha and Kaśyapa, ... and Atri."

From this passage, clearly, it appears that the verse is understood, at least by the Upaniṣadic thinker, as referring to the asterism saptarṣayaḥ, the seven Ṛṣis, or in our parlance, Ursa Maior, The Great Bear, Wain, or Wagon. The names given by the Upaniṣad are, of course, those of the traditional Seven Ṛṣis, but also the names of the actual stars of the Great Wain.[68] *Further, the passage actually says that the seven seers sit right on the rim (tire) of the heavenly casket. In fact, we could not wish for a clearer identification -- and it is strange that it has eluded us for so long.*

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[66] Also *Ṛgveda* V.83.8 "Scoop up the large bucket, pour it out at its proper place, let the rivulets, set free, run forwards!"

[67] For the meaning of kheda "cord" see A. Wezler, *Zum Verstaendnis von Chandōgya-Upaniṣad 5.1.12. StII 8/9* (1982),155-188. This could mean that the sun (or here, Indra, the brother of the sun god Vivasvant) pulls up the kosa during its nighttime movement, as a sort of counterweight.

[68] See J. E. Mitchiner, Traditions of the Seven Ṛṣis, Delhi 1982.

(2) Discussion on Witzel's Account

• As has been pointed out already Witzel has a frame of mind that forbids even the thought of an antiquity of 1500 BC for the Vedic literature and 500 BC for Śatapathabrāhmaṇa. Therefore, the reference to a polestar obviously meant the Polaris, which attains maximum declination of $+89^0$ 32'23" only in February 2102, when it will be closest to the pole. Thus, Witzel had taken it to be the pole when it was away from the north celestial pole by 2600 years in 500 BC.

•On the contrary, Thuban had the maximum declination of $89^0$58'14" in 2792 BC and thus precisely marked the pole. Even with the Witzel's antiquity of 1500 BC for the Vedic literature the polestar referred to in Vedic literature must be Thuban.

• Now the matter remains to be resolved is: Which of the above polestars match well with the descriptions available in Vedic literature of the heavens as well as the heavenly casket?

(3) Vedic Descriptions of the Great Bear and the Polestar

Hindus have long back forgotten their celestial Bears, but the Vedic literature contains a record of the ancient affiliation of the Bears with the Hindus:

Ṛgveda I.24-10: "*These Bears (Ṛkṣa) which appear to be placed high in the sky at night disappears during the day*"

Śatapathabrāḥmaṇa II.1-2.4:*"The Saptarṣis were called Bears in ancient times".*

These solitary references available in the vast mass of Vedic literature when contrasted with the astro-mythological legends of the ancient cultures, we can find a striking resemblance that point towards the origin of these legends in the pre-historic Vedic past of India. Especially we must note here that the Śatapathabrāhmaṇa which itself is of great antiquity mentions the "Bears" as have become obsolete in course of time. In the words of Peter Lum:[69]

"It was in India that the seven stars seem to have been first identified with a bear, an association which is thought to have arisen from a confusion of words. The same root word of the Aryans, "riksha", which meant, "to shine" and was therefore applied to the stars, was also used in a different gender to mean, "bear". The latter meaning gradually became the more common and the original epithet of "shining" was forgotten, so that when men looked up and saw the seven rikshas they believed that these were supposed to be seven bears or, finally, one bear formed out of seven stars. There was a still further confusion when the original "riksha" was confounded with a similar word, "rishi" which meant a sage or poet. In the end Ursa Major was identified with the seven wise men of India, those seven rishis who sailed with Manu in the Ark and thus escaped the universal deluge. The bear was forgotten. But in the mean time the conception of the constellation

[69] Peter Lum, *The Stars in our Heaven*, Thames and Hudson, London.

as a bear had spread westward into other lands and other mythologies and was firmly fixed, having given birth on the way to many and varied legends explaining why the Sky-bear had a long tail, why he never set under the horizon like other stars, why his feet never touched the sea, and how he had ever reached the far north in the first place." (sic)

The genesis of Great Bear and the Seven Sages as explained above illustrate the process by which many astronomical mythologies might have taken shape. Even in prehistoric accounts such as in the reference to 'Sages' vis-à-vis 'Bears' in the Śatapathabrāhmaṇa, we can hear of the nomenclature of ancient times as legends of obsolete traditions. How could the ancient Ṛgvedic name and its rationale be lost by the time of the Śatapathabrāhmaṇa? How much time might have elapsed in the transformation of the 'seven shining stars' to the 'Seven Sages' and what might be the antiquity of those original stargazers who have named it with the correct rationale? Is Great Bear an isolated occurrence – what about the nomenclature of other constellations such as the Canis group (Dogs) and the Argo Navis?

It will be easy to relegate the above questions to the background with the presumption that the 'Great Bear' is an isolated occurrence of Indian connection belonging to the remote past, in view of it being circumpolar at latitudes greater than 30^0 in the northern hemisphere. In fact it is not so becomes evident on examining the constellational nomenclature and mythologies of the East and West.

Mythology of the Great Bear and the Polestar

It was H.Jacobi who first pointed out the reference to polestar as the symbol of steadfastness in the description of marriage rite of the Gṛhyasūtra-s and made use of it in fixing the antiquity of the custom contained in it. The present polestar, which will have its closest approach to the Pole in 2102 AD, could not have been the source of this tradition. The Dhruva who matches with the Vedic antiquity is Thuban (α-Draconis), which marked the Pole around 2831 BC. At these remote epochs the Great Bear or the Seven Sages were closer to the pole and this led to the origin of many legends that inter-relate the Sages with the Dragon (Draco). The astronomical observations of the above epoch find an echo in many hymns of the Ṛgveda itself.

Ṛgveda I.164-2: *"Seven horses are harnessed to that one-wheeled chariot; but only one horse bearing seven names draws it. The wheel has three hubs and it is eternal and unhindered, and all worlds stand supported by it".*
I.164-3: *"The seven horses mounted on the seven-wheeled car draws them onward as if seven sisters are singing together the names of the seven cows".*

The astronomical phenomenon that inspired these hymns can be well understood from the following words of Peter Lum:[70]

"As we have seen, the pole star four thousand years ago was not our pole star but instead was Thuban, a bright star in the tail of Draco. At that time the entire heavens

[70] Peter Lum, *The Stars in our Heaven*, Thames and Hudson, London.

would have appeared to revolve around Thuban, the only fixed point in the sky, as they now appear to revolve around Polaris. It would have been on Thuban that the early stargazers fixed their eyes when they tried to find some center and some order in the spinning universe. The whole of Draco would then have been nearer to the pole as well, coiled in a tight and ever revolving small circle around the north star".

In fact the Seven-sages also would have appeared closer to the pole and would have circumvented it as if seven horses are mounted to the one-wheeled chariot of α-Draconis. α-Draconis had a separate identity in view of its fixity of being Dhruva despite its proximity to the Saptarṣis and this is reflected in the words of the Ṛṣi who speaks of the – *"only one beyond the Seven-sages"* at Ṛgveda X.82-2. Further, substantiation of this idea is available at Taittirīya Āraṇyaka I.7-20, which refers to the 8th Sage Kaśyapa who sticks on to the Mount Meru (North Pole). The word "Kaśyapa" means 'Tortoise' i.e., with the inclusion of the 8th star the Bear got transformed into a Tortoise situated over the pole. The precession or revolution of the polar axis is very slow and akin to the movement of a tortoise and hence the above allegorical title 'Kaśyapa' was given to the 8th Sage or Polestar. The following Ṛgvedic hymn is noteworthy in this context:

Ṛgveda X.22-1: *"Where is famed Indra heard of? With what folk is he renowned today as Mitra is-who in the* ***home of Ṛṣis*** *and in secret (in the forest- Sāyana) is extolled with song?"*

It is well known that the Vedic Indra represents the summer solstice. Equator being perpendicular to the pole the solstices are synonymous with the poles over the ecliptic and hence the above reference to Indra and the 'home of Ṛṣis' simultaneously.

Further at X.22-10: *"Urge the heroes to slay the* ***dragon,*** *brave thunderer (Indra)... even when hid among the tribes of Sages as numerous as stars"*

The slaying of Vṛtra (Ahi) or the Dragon to cause the rains is an astro-mythological allegory of the placement of α - Draconis at the pole, which corresponds to the summer solstice at which the rainy season commences. "the tribes of Sages as numerous as stars" clearly reflect the Seven-sages and the Dragon hiding among them is obviously the polestar α - Draconis. Similarly, the Ṛgvedic hymn I.32.1-15 speaks of the fight between the rain-god Indra and the Dragon lying on the mountain (Meru or the Earth's axis). The relative placement of these stellar characters of Great Bear and Draco can be understood from the following data:

Stars of Great Bear	Sidereal Ecliptic	
	Longitude	Latitude (N)
Kratu (α -Ursa Major)	110°37'	49°41'
Pulaha (β -Ursa Major)	114°51'	45°08
Pulastya (γ -Ursa Major)	125°53'	47°08'
Atri (δ -Ursa Major)	126°29'	51°39'
Aṅgirah (ε -Ursa Major)	134°21'	54°19'
Vasiṣtha (ζ-Ursa Major)	141°07'	56°23'
Marīcī (η -Ursa Major)	152° 21'	54°23'

Stars of Draco		
λ-Draconis	$105^0 45'$	$57^0 14'$
κ-Draconis	$111^0 40'$	$61^0 46'$
α-Draconis (Thuban)	$132^0 52'$	$66^0 22'$
ι-Draconis	$160^0 22'$	$71^0 06'$
ζ-Draconis	$158^0 48'$	$84^0 46'$
β-Draconis	$227^0 23'$	$75^0 17'$
ξ-Draconis	$240^0 10'$	$80^0 17'$
γ-Draconis	$243^0 23'$	$74^0 55'$

It is apparent that Draco and Great Bear would have been circumpolar at latitudes greater than 30^0 and 45^0 respectively had there been no appreciable change in the latitudes of these stars due to proper motion.

Associated Purāṇic Legends

Now at the fag end of the paper the present author is desirous of placing some astronomical interpretations of Purāṇic legends for the attention of the intelligentsia. As noted by the referee the meanings ascribed may not be that obvious to all and may have alternate interpretations. The antiquity we have discussed above is anyway not dependent upon the acceptance of the meanings we have ascribed to these legends. The question may arise as to then what for the inclusion of these thoughts are attempted. Astronomical interpretation of Purānic legends have got a long history beginning with the times of Bālagaṅgādhara Tilak, Sengupta, Karaṇdikar and others. With the advancement in astronomical/planetarium software now the time has come to attempt a more meaningful interpretation of such purāṇic legends. It is in this respect that the following thoughts are appended to the main theme of the paper with the hope that other scholars will attempt more meaningful interpretations of these legends. Author may kindly be excused for any wrongful or shallow interpretations given below:

(a) Nahūṣa's reign as Indra and his ride over the Seven-sages to meet Indrāṇi is another related astro-mythological legend. Nahūṣa uttered 'sarpa', 'sarpa' to speed up the Sages and received the curse of Aṅgiras to become a Sarpa or serpent (Dragon). This legend in fact refers to the reign of one of the stars of Draco as the Polestar and its subsequent fall. Reference to Nahūṣa can be found in the Ṛgveda itself and is reflective of the antiquity of the astronomical observations by the Vedic Ṛṣis. Note the cryptic astronomical clue 'Sarpa' that appears in the allegory to stand for the Draco.

(b) Yama as personification of the polestar
As regards Draco, R.H.Allen makes the following comments:[71]

"In Persia Draco was Azhdeha, the Man-eating serpent, occasionally transcribed Hashteher; and, in very early Hindu worship, shi-shu-mara, the alligator, or Porpoise, which also has been identified with our Delphinus".

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[71] Allen, R.H. Star Names, Their Lore and Meaning, Dover, 1963.

Viṣṇupurāṇa II.9-1 provides concrete justification for the above identification of Draco with "Śiśumāra" and refutes the alleged connection to Delphinus or Makara of the Hindus.

> *"Tarāmaya bhagavataḥ śiśumārākṛti prabhoḥ;*
> *Divirūpaṃ hareryattu tasya pucchestito Dhruvaḥ".*

The word 'śiśumāra' has a variety of meanings such as – "child killer", the Gangetic porpoise or Dolphin, Delphinus Gangeticus, an alligator, a collection of stars supposed to resemble a Dolphin and held to be a form of Viṣṇu and as a personification of the father of 'Bhṛami' (note the word meaning) wife of Dhruva. The astronomical dimension of the term is well evident from these meanings given in the Sanskrit- English dictionary of M.Monier Williams. Other meanings possible are – Child or little Yama i.e., Yama-kumāraḥ, who was the sun of Vivasvān and Saraṇyu. Ṛgveda X.17.1&2 refers to the birth of Yama as the son Vivasvān (sun) and Saraṇyu. Explicit reference to Yama's location is available at Ṛgveda I.35.6, which speaks of the three heavens- two of Savitar and one of Yama – the home of heroes that remains firm and immortal as on a linch-pin.

Further Ṛgveda X.135.1 to 7 provide a detailed account: *"In the tree clothed with godly leaves where Yama drink with the Gods, The Father, Master of the house, tendeth with love our ancient Sires (Seven-sages)".*

Ṛgveda X.135.3: *" Thou mountest, though thou does not see, O child, the new and wheel-less car which thou has fashioned mentally, one-poled but turning every way".*

Ṛgveda X.135.4: *" The car, which thou has made to roll hitherward from the Sages, child! This hath the saman followed close, hence, laid together on a ship".*

Ṛgveda X.135.5: *" Who was the father of the child? Who made the chariot roll away? Who will this day declare to us how the funeral gift was made?"*

Ṛgveda X.135.7: *"Here is the seat where Yama dwells, that which is called the Home of the Gods: ..."*

Especially noteworthy is the fact that 'Kumāra' has made the car "one-poled but turning every way" to roll hitherward from the Sages. Above hymn, X.135-5 also explains the origin of the Arabic legend, which considers the Great Bear as ' Mourners' or a funeral procession. R.T.H.Griffith has mentioned the ship placed close as the funeral pile and this is reflective of the Arabic coffin formed by Dubhe (α - Ursa Major), Merak (β - Ursa Major), Phecda (γ-Ursa Major), and Megrez (δ - Ursa Major). Analogues are the western legends that describe the Great bear as 'Arthur's chariot or Wain ' (England), King David's chariot (Ireland), Wagon (German) etc. Even Homer described them as Great Bear or Wain and R.H. Allen has quoted Miss Clerke to illustrate the genesis:[72]

"...we infer, then, that the Babylonian Bear was no other than Ursa Major....Thus circling the globe from the valley of the Ganges to the great lakes of the New world, we find ourselves confronted with the same sign in the northern skies, the relic of some primeval association of ideas, long since extinct. Extinct even in Homer's times"

None of the above legends is as descriptive of the astronomical element as the earlier mentioned hymns which speak of a *'Kumāra turning the chariot counter-clockwise from*

[72] Allen, R.H. *Star Names, Their Lore and Meaning*, Dover, 1963.

the sages'. The word 'Kumāra' is an appellation of Dhruva: Ṛgveda I.155-6, has described sun as 'akumāra' in view of its revolution relative to earth and as such the term refers to the status of being a fixed reference. It is apparent that the use of the term is cryptic and translation of 'Kumāra' as 'child' is not that proper. According to the last of the hymns quoted above the seat of Yama is in the 'home of the gods' and this obviously refers to the Mount Meru where sun attains maximum declination.

(c) Related Legends of Viṣṇu and Indra

Viṣṇu as the son of Kaśyapa and Aditi is another astro-mythological depiction of the phenomenon of precession of the equinoxes. Kaśyapa, as we saw above already, has the Pole as his permanent abode while Aditi represents the ecliptic. Kaśyapa means a tortoise – one of the Avtars of Viṣṇu. Matsya and Varāha also probably arose out of the stellar configurations of Ursae Major, Draconis and Ursae Minor. Peter Lum's description of the Dragon reminds us of the dance of Krsna over the head of serpent Kāḷiya:

"The Dragon is certainly a remarkably twisted constellation and it is one which is not so well known as it should be. The tail of the monster lies between the Great and lesser Bears, his body coils itself with many a star-strewn loop around three sides of the Little Bear and then twists back until a triangle of star forms a wicked-looking, pointed head just below the foot of Hercules..."

Hercules is Kṛṣṇa and Kāḷiya is the Dragon without much of a doubt. Kāḷiya's abode is Yamuna, an allegorical term that implies a co-born of Yama. Kāḷiya may have etymological links with the term Kāla also which stands for Yama and obviously, the story has its origin in the polar circle. Clinching evidence is available in the reference towards the 'Kadaṃba' tree from which Kṛṣṇa jumped over Kāḷiya, who had his residence below. 'Kadaṃba' is a well-known astronomical term, meaning - the pole of the ecliptic and thus provides a reassurance for the inference drawn above.

It is apparent from the above discussion that the polestar referred to in Vedic literature can only be the α-Draconis rather than Polaris.

- **Conclusions**

The Vāyupurāṇa record of planetary positions and the occultation of Alcyone or Kṛttikās by Moon declare null and void all the criticisms against the dating of Vedic astronomy to 2500 or 3000 BC. The explicit record leaves no scope for the preconceived notions of scholars like Witzel to search for some interpretational contrivance such as "linguistic, spiritual, social and political developments of the ZB" to scale down the antiquity of Vāyupurāṇa record to 500 BC.

Vedic references to Great Bear or *Saptarṣis* and the polestar provide complete substantiation towards the above inference. Purāṇic legends leave no doubt for the identification of the polestar as belonging to the constellation of Draco.

Dedication

This paper is dedicated to the genius of Late.Srī. K.L. Daftari who had dated the planetary observational record of Vāyupurāṇa correctly in the 1940s by manual computation.

• In reproducing this paper completely repetition of a few paragraphs have occurred which we have already seen in the discussion on Vedic astronomy. However, with these repeated paragraphs it is easy to note that the paper didn't leave any scope for confusion as regards the existence of astronomy in epochs such as 2500 BC.

• Refereeing in India

Paper failed to appear in IJHS as the author failed to meet the requirements of the referee and the editor:

Referee's comments on the resubmitted paper was:

"*The revised version takes care of the most points raised in the earlier comments. But the author insists on including Puranic evidence. In my opinion it reduces the scientific value of the paper. Anyway I leave this point to Editor's discretion.*"

Against this referee-report the editor has stated that the referee has raised a methodological problem, viz:

"*(i) Vayupurana is not considered to be a part of Vedic literature. If Chakshusha Manu has Vedic identity it should be corroborated with the quotation from the Vedas.The revised version does not address this question except to say (on p.9) that the Vedas are not 'Who's who'*"

This statement of the editor was false as sufficient clarification was given at page 9 of my resubmitted paper under the title 'Vedic Identity of Cākṣuṣa Manu'. In a rejoinder the following clarifications were sought from the editor:

"*Is this clarification not sufficient with respect to the comments given by the referee in the first report? In the second report referee has not mentioned this aspect at all and his reservations were limited to the Purāṇic evidence, which I did not delete when the paper was resubmitted. It is therefore obvious that the referee considered the above clarification as satisfactory.*

→ *Coming to the objection you have articulated viz., the methodological problem, can you kindly enlighten me as to what kind of a solution did you expect for the above problem?*
→ *How could I have given a quotation from the Vedas when the Vedic Index of Keith and MacDonnell have no mention of the name Cākṣuṣa?*
→*The fact that K.L.Daftari has treated Cākṣuṣa as a Vedic personality has no value in your eyes?*

→ *Are you ignorant of the stature of K.L.Daftari as an authority on the history of Vedic antiquity? If not how could you ignore the clarification I have given?'*

Further, the allegation that the author insisted for the inclusion of Puranic evidence is also wrong. In the covering letter to the paper under reference, author did express clealrly that the matter may be decided on the discretion of the editor. However, the editor and the referee wanted cent percent conformance with the pet picture/notions they had about a paper. Author did also raise the following questions to the editor:

→ *By adding a few creative interpretations of the Puranic legends, a paper based on scientific analysis will loose its value? Have you gone through the works of Prof.PC Sengupta, B.G.Tilak, Whitney, etc., ever?*
→ *As I have asked you in the past what are the criteria with which the suitability of a paper is adjudged?*
→ *Do you have any guidelines and a precise format for the referees to report on the papers?*
→ *Do you have any knowledge of the international practice in this regard?*

To conclude the present discussion

Relevant format of an international journal's referee report is reproduced below:

Referee's Report

Author/s:
Title:
Manuscript Number:

•Please answer each question and add any detailed comments. Minor comments may be made lightly in pencil on the typescript.

1. Do you recommend this paper for publication in the Journal of ... from the standpoints of:

   a) Originality,
   b) Effective presentation, and
   c) Soundness and up-to-date treatment of the topic?

   Yes: Without change or with very minor changes:
   With major revisions/ additions as detailed.
   No: Not acceptable.

2. Is the Abstract an adequate summary of the paper?

3. Is the paper adequately condensed? If not, what parts could be improved by condensation?
4. Are all figures essential and acceptable?
5. Is proper credit given to related work and sources?

• I leave it to the intelligentsia to decide as to whether the papers given above did receive a fair evaluation in respect of originality, effective presentation, soundness and up-to-date treatment of the topic. Even in the west, scholars are ready to discuss the astronomy contained in ancient Vedic/Upaniṣadic myths but here in India such interpretations have no place in history of science.



XII

ASTRONOMICAL INTERPRETATION OF MYTHOLOGY

The script of one of the oldest civilizations that strived in Indus Valley remains largely enigmatic. As is known the most ancient literature available in the subcontinent makes no direct mention of these ancient sites. Harappa and Mohenjo-Daro were discovered in the 1920s and since then more than thousand other sites have been discovered between Narmada in the south and Oxus in Central Asia. Since the collapse of the civilization around 1900 BC, there is no evidence of a script until about 400 BC in India. Therefore, the dawn of not only the most ancient civilization of the Indus Valley but also that of the Gangetic plain remains shrouded in mystery.

The Romans originally had a complicated lunar calendar of ten months from March to December. By adding January and February subsequently they managed a year of 355 days with the 12 months:

Martius, in honor of Mars (God)
Aprilius, the 'blossoming' one
Maius, in honor of Jupiter (God)
Junius, in honor of Junii (a Roman clan)
Quintilis, the 5th month
Sextilis, the 6th month
September, the 7th month
October, the 8th month
November, the 9th month
December, the 10th month
Januaris, in honor of Janus (God)
Februarius, month of Februa (feast)

January was made the first month in 153 BC. Julius Caesar in 46 BC made the year solar on the suggestion of Sosigenes and introduced the leap year having an extra-day in February. In 321 AD emperor Constantine introduced the Jewish seven-day week to do away with the complex system of calends, nones and ides. At the Council of Nicea in 325 AD Sunday was accepted as the first day of the week and was set aside as the Christian day of worship. In 527 AD, Dionysius Exiguus, the abbot of Rome began the practice of dating events (AD/BC) from a back-computed birth date of Christ.

XII

ASTRONOMICAL INTERPRETATION OF MYTHOLOGY

We saw above the attitude of those who are at the helm of affairs in historical research towards the purāṇic contents and its interpretation. This in turn is reflective of the fact that even in independent India during the last five decades no serious efforts have taken place to understand the real meaning of a vast amount of ancient literature. We have relegated a significant part of our heritage as simple mythological nonsense despite the key insights into their mystery provided by many well-respected scholars such as Tilak, Karandikar etc. In the preceding chapters, we have already attempted the astronomical interpretation of certain mythological episodes while trying to crack the prehistoric origin of the Rāśicakra and here the matter is pursued further under the same paradigm of interpretation. Two papers that have failed to appear in the Indian Journal of History of Science are reproduced below exactly as they were submitted to IJHS.

Paper -I

Indradhvaja – A Pointer towards Vedic Antiquity

Abstract

Astronomical interpretations have been attempted of many Purāṇic episodes by erudite scholars like Tilak, Karandikar, Sengupta etc., to derive information regarding the antiquity as well as development of astronomy. On combining the interpretations of both Sengupta and Karandikar on 'Indradhvja' and the Purāṇic hero Vāmana respectively, we get evidence of solstice observations in the distant antiquity when Bhādrapada sukḷa dvādaśi coincided with summer solstice. With the astronomical details deciphered from the legends of Indradhvaja, Vāmana and Mahābali, present author has attempted to precisely determine the epoch at which the legend took shape. The epoch at which the celebration of Indradhvaja was instituted or the mythological defeat of Mahābali at the trickery of Vāmana is shown to have took place on 26 July 4136 BC. The astronomical phenomena of this epoch truly reflect the caricature of Mahābali available in the Mahābhārata.

1. Introduction

Ever since the days of early European scholars the antiquity and substance of ancient Indian astronomy had an aura of suspicion around it contributed by conflicting theses on the historicity and astronomical content of the Vedic hymns. Complexity and confusion increased further in the aftermath of the archaeological discovery of Indus valley civilization, when the antiquity deciphered out of the hymns by scholars like H.Jacobi[1] and B.G. Tilak[1] got credited to the so-called Dravidians of Harappā at the cost of Vedic Ṛṣis by historians like D.P.Chattopadhyaya[2]. The ensuing period witnessed a proliferation of speculative theories on the history of India and it's Vedic past woven around the theme of "Aryan Invasion". At the turn of the present century the trend is still continuing among the mainstream historians but certain recent developments have struck the very bottom out of the so called "Aryan Invasion Theory" and the ground is set for a revision of the established notions that place the Vedas chronologically at 1000-1500 BC. Portals of truth has begun to become apparent with the decipherment of the Indus script vis-à-vis the discovery of Vedic glossary on the Indus seals[3] .The high antiquity of Vedas can no longer be doubted and the credibility of Vedic literary evidence stands reestablished. History of science as created by people like D.P.Chattopadhyaya is in dire need of revision as the Aryan myth has crumbled with the surfacing of Sanskrit glossary in the ruins of Indus valley civilization. Time is thus ripe to attempt a better appreciation of the ancient Indian astronomical tradition that we find reflected in the Vedas, Purāṇas and the Epics. In this context the celebration 'Indradhvaja' as referred to by Varāhamihira in Chapter XLIII of Bṛhatsaṃhitā offers enough substance for a discussion on the antiquity of Vedic astronomical tradition.

2. Varāhamihira and Sengupta on Indradhvaja

Bṛhatsaṃhitā XLIII.1-5 provides a mythological account of the origin of Indradhvaja on the following lines:[4]

XLIII.1:"Once the celestials submitted to the Creator: 'Oh Lord, we are unable to withstand the demons in battle. Consequently we have come to you, the protector of the helpless'".

XLIII.2: "The Lord replied to the Gods thus: 'Lord Nārāyaṇa reposing on the Milky Ocean will grant you a Banner (Dhvaja), at sight of which the demons will not be able to face you on the battlefield'".

XLIII.3-5: "The Gods with Indra as their leader approached Nārāyaṇa... The Lord, being pleased with their invocations, vouchsafed unto them a banner ...".

Varāhamihira further spokes of the victory of Indra over the Asuras with the Dhvaja and

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[1] S. N. Sen. Survey of studies In European Languages, IJHS, 1985, **20** (1-4), PP 85-87.

[2] D.P.Chattopadhyaya. *History of Science and Technology*-I, Firma KLM, Calcutta

[3] Natwar Jha. *Vedic Glossary on Indus Seals*, Ganga-Kaveri Publishing House, Varanasi

[4] M.Ramakrishna Bhatt, *Bṛhatsaṃhitā* Part-1, Motilal Banarsidass, Delhi, 1986, pp.344-345

acquisition of the same by a king named Uparicaravasu from Indra etc. The story of Uparicaravasu is available in the Mahābhārata[5] also. Śloka 13 -17 refers to Indra's gift of Vimāna, Vaijayantīmālā and Vaiṣṇvayaṣṭī to king Vasu and the subsequent ones describe the glory of Indrotsav by the installation of Vaiṣṇavayaṣṭī. Śloka 20-24 further say that the Indra is worshipped on the first day of the New Year by installing him as a 'Haṃsa' over the staff and Indra himself adorned the same form to accept the oblations. An elaborate discussion on the topic is available in *Ancient Indian Chronology* by Sengupta[6]. Sengupta has quoted Bhaṭṭotpala's commentary on the Garga's verses quoted by Varāhamihira:

"The Asuras on seeing that flag were struck by its brilliance, got confounded and of broken ranks, defeated and fled in the month of Bhādrapada. The thousand-eyed Indra by his thunderbolt killed the Asuras in the night in which the moon was at Antares, went to heaven after winning the battle, on the night with the moon, whom he met on the way at the star Śṛāvaṇā (Altair)".

Further on page 92, we can find the following quote from Garga and the related comments:

"There the hoisting of the flag is to be preferred in the 12th tithi with the moon near the star Śṛavaṇa (Altair) either in the muhūrta of the day which is known as Vijaya or Āśva or in any other part of the day".

Sengupta continues:(6)

"A muhūrta = 1/30th part of day and night or 24 hours. The muhūrta, which is here called Vijaya was perhaps the 8th and Āśva the 4th which in the astronomy of the Atharvaveda are respectively called Abhijit and Sārabhaṭa. The day for the hoisting of Indra's flag is even now shown in Hindu calendars, though the ceremony is now more honoured in the breach than in the observance. Hence the day of hoisting of the Indradhvaja is the anniversary of Indra's victory over the Asuras or the clouds. We take it that this was the day of the summer solstice according to the recorded tradition".

In fixing the epoch Sengupta's calculation proceeds as follows:(6)

On subtracting the longitudinal arc corresponding to 11 tithis of the bright half (= 132^0), from the position of Altair (301^0) the respective position of sun is obtained as 169^0. Based on some approximations he arrives at 15th September 1929 as the date of true anniversary of Indra's victory, which was the day of summer solstice of the required epoch. As this anniversary had a longitude of Sun equal to $173^0 58'$ as against the 90^0 at the ancient epoch, this suggests a shift of the solstices by 84^0. That is, the time has to go back by approximate 6000 years, to 4000 BC.

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[5] *Mahābhārata* Part-1, Ch.63, p.172. Gita Press, Gorakhpur.
[6] Sengupta, *Ancient Indian Chronology*, pp. 90-92, Pub: University of Calcutta, 1947

3. Indra's Identity as Summer Solstice

It is really noteworthy that an erudite scholar like Sengupta has identified Indra as one of the cardinal points and the associated legends as astronomical allegories containing the symbolic descriptions of ancient astronomical events or calendar features. On a critical assessment of Sengupta's notions, the first question that emerges is that whether the Vedic people had so much astronomical advancement as to speak of a cardinal point or Year-beginning in symbolical terms as an allegory? An intellectual accomplishment of this sort demands the existence of a society scientifically and artistically advanced as to appreciate both the astronomy as well as the allegory framed out of it. See for example, the description of Indra in astronomical detail as a 'Haṃsa' on the day of New Year coinciding with the summer solstice. 'Haṃsa' referred to in the legend is obviously the constellation of Cygnus, the Swan placed across the signs of Makara and Kuṃba, over which the moon will have its sojourn on the day of solstice. It is therefore evident that the legend has been framed meticulously with the incorporation of the relevant astronomical details so as to enable the transmission from one generation to another. Further, it is possible that in ancient days such legends were meant to serve the purpose of memory capsules and were taught to the new generation along with the relevant astronomical and historical details.

As regards the question of fixing the solstices in such early days as 4000 BC or even as late as 1400 BC, we have the following interesting comments from Prof. Whitney:[7]

"*The place of the equinox is not to be determined by going out and watching the heavens; It is a deduction from observations, by combinations and inferences, which lie quite out of the power of men unskilled in astronomical science. That either the ancient or modern Hindus have had the capacity to grasp clearly the conditions of the problems involved, and solve them successfully, is to say the least not very probable. I should not expect, from them a nearer approximation than within several degrees on the one side or the other. Putting together all these sources of error, we shall see clearly that no definite date is capable of being extracted from the statement of Vedāṅga Jyotiṣa It is not easy to make a valuation of figures of elements so indefinite; but it is safe to say that a thousand years would be not too long period to cover all the uncertainties involved*'.

In these words Whitney has termed even the solstice record of the Vedāṅga Jyotiṣa, which is dated differently as around 1400 BC to 500 BC, as inaccurate and unreliable. On the other hand, as regards the possibility of reliable solstice observations we have the following observations by Alberūṇi to elicit a more fair and judicious assessment of Indian astronomy:[8]

"*They have adopted the time of the summer solstice as the beginning of the year for the reasons, in particular, that the two solstitial points are easier to be ascertained with the help of instruments and by observations than the equinoctial points, for the former are the beginning of the advance of the sun towards one of the two poles of the Universe and of*

[7] Whitney, Quoted from a secondary source: *Vedic Astronomy and Mythology*, A.J. Karandikar

[8] Alberūṇni, Quoted from a secondary source: *Vedic Astronomy and Mythology*, A.J.Karandikar

his turning away from the same pole. If the perpendicular shadow at the summer solstice is observed and the level shadow at the winter solstice in whatever place of the earth, the observation be made, the observer cannot possibly mistake the day of the solstice, though he may be entirely ignorant in geometry and astronomy, because a variation of the level shadow takes place notwithstanding the small amount of declination, if the height is considerable. On the other hand the two equinoctial days cannot be ascertained unless you have the latitude of the place and the general declination. And this nobody will be able to find out unless he studies the science of astronomy and knows how to use the instruments of observation".

It is apparent from the above that solstice observations could have been possible in ancient India with the aid of a gnomon and the Year beginning with the summer solstice might have undergone personification as Indra in due course. Alberuni itself, who was an alien to this land and little acquainted with the Vedic tradition, observed the fact that 'Personification' of each and everything was a fashion with the Hindu antiquity. To quote:[9]

"*The Hindus can never speak of anything, be it an object of the intellect or imagination, without representing it as a personification, and individual. They at once marry him, make him celebrate marriage, make his wife become pregnant and give birth to something. So,too, in this case. The Vishnu-Dharma relates that Atri, the star who rules the stars of the Great Bear, married the directions, represented as one person, though they are eight in number, and that from her the moon was born...*"(sic)

See further what Umapada Sen has to say:[10]

"*In the Ṛgveda, solstices and equinoxes have been often cloaked under allegory or metaphor.... Indra steels the chariot wheel of sun* I.*175.4,* IV.*30.4 etc., and uses this as a quoit against the demon of draught. It clearly point to summer solstice when sun advances no more to the North and rainy season commences...*".

In the light of the above observations, the identification of Indra as personification of the summer solstice appears quite sensible.

4. Evidences for the Observation of Solstices

Prof.Sengupta has discussed the matter in detail. To quote:[11]

"*The method of the Vedic Hindus for determining the solstice days is thus expressed in the following passage from the Aitareya Brāhmaṇa.... Sāyana has failed in his exposition of this passage, which relates to observational astronomy, and no one who is unacquainted with this branch of science can possibly bring out any sense of it. We follow Keith generally with some modifications in the translation, which is given below:*

'*They perform the Ekaviṃśa day, the Viṣuvān, in the middle of the year; by this Ekaviṃśa*

[9] Alberūṇi, *India*, p.133, National Book Trust, 1995, Editor; Ahmad Queyamuddin
[10] Umapada Sen, The Ṛgvedic Era, p.53, Firma KLM, Calcutta, 1974
[11] P.C.Sengupta, Ancient *Indian Chronology*, pp. 155-164, University of Calcutta, 1947

day the gods raised up the sun towards the world of heaven (the highest region of the heavens, viz., the zenith). For this reasons this sun (as raised up) is (called) Ekaviṃśa. Of this Ekaviṃśa sun (or the day), the ten days before are ordained for the hymns to be chanted during the day; the ten days after are also ordained in the same way; in the middle lies the Ekaviṃśa established on both sides in the Virāj (a period of ten days). It is certainly established in the Virāj. Therefore he going between (the two periods of 10 days) over these worlds, does not waver'.

'The gods were afraid of this Āditya (the sun) falling from this world of heaven (the highest place in the heavens); him with three worlds (diurnal circles) of heaven (in the heavens) from below they propped up; the Stomas are the three worlds of heaven (diurnal circles in the heavens). They were also afraid of his falling away upward...'

In a nutshell, *Aitareya Brāhmaṇa* has recorded the observation that sun remained stationary for a period of 21 days or more precisely during a period of seven days and the Vedic people could ascertain this by observing the noon shadow of a vertical pole. Sengupta gives the following details: [11]

"If we assume that the observation was made at the latitude of Kurukṣetra (about 30^0N) and when the obliquity of the ecliptic was about $24^0 15'$, and the height of the pole was taken equal to, say, 6ft., then:

(a) When the sun had a longitude of 80^0, the length of the noon shadow =7.44 inch.
(b) When the sun had a longitude of 87^0, the length of the noon shadow =6.98 inch.
(c) When the sun had a longitude of 90^0, the length of the noon shadow =6.93 inch.

Now 7.44 – 6.98 = 0.46 inch and 6.98 – 6.93 = 0.05 inch. Hence by use of any sort of measuring rods, they could perhaps easily discern a change in the noon shadow of about half an inch, but a difference of 0.05 inch was, of course, was quite impossible of perception with them. They could thus infer that the sun remained stationary at the summer solstice for 7 days when they used any measuring rods and when they used rougher methods they could conclude that the sun remained stationary for 21 days at the summer solstice...It should thus be clear that the Vedic Hindus knew how to determine the summer or the winter solstice day. When they found that the sun apparently remained stationary at the solstice for 21 days, the true solstice day was the 11^th^ and when they found that the sun remained stationary for 7 days, they took the 4^th^ day as the real solstice day".

In a footnote Sengupta offers the following comments on the Varāhamihira's mention of the methods for fixing the solstice: [11]

"The solstice day may be determined by observing the coincidence of the sun at the time of rising or setting with a distant sign-post or by the marks of entrance or exit of the tip of the shadow of a gnomon in a large horizontal circle (having for its center the foot of the gnomon). Here two methods are described by Varāhamihira in the first of which the sun's amplitude at sunrise or sunset is to be observed. If the Vedic Hindus followed this method, they could perhaps observe the sun to remain stationary, i.e., without any

appreciable change of amplitude, for 21 days near the solstices. It does not appear probable that the second method was followed by the Vedic Hindus..."

The second method suggested by Varahamihira can also be found in the Pañcasiddhāntikā IV.19, and there is not much ground to believe that it was not known in ancient days. The detailed records of winter solstice observations available in the Brāhmaṇa literature amply illustrate the social significance of the event and there cannot be any doubt that the Vedic people had sufficient intellectual caliber as to devise appropriate methods for observation. Vedic literature cannot be expected to contain exhaustive description of the astronomical methods and as such the only recourse is to infer such details circumstantially from other known factors. We can find the records of the line of solstices/equinoxes from a date as early as 1900 BC in the ancient literature:

• Maitrāyaṇa Upaniṣad VI.14:[12]

> *"Ardhamārdhaṃ Vāruṇaṃ Maghādyaṃ Sraviṣṭhārdhabhāgneyaṃ*
> *Kramenot kramena Sārpādyaṃ Sraviṣṭārdhāntaṃ Saumyaṃ ..."*

This is an explicit description of the Zodiac having 108 "stellar-quarters" i.e. nakṣatra-pādas or navāmśas with the solstitial line across $300^0 - 120^0$. The epoch as per modern computation as above will be BC 1941 – probably the crucial epoch at which Sarasvati disappeared.

•• Viṣṇu-purāṇa II.8.78, 79:[13]

> *"Viśākhānāṃ yadā Sūryaścaratyaṃśaṃ tṛtīyakaṃ*
> *Tadā Candraṃ Vijānīyād Kṛttikāśirasi sthitaṃ* |78|
> *Tadaiva Viṣuvākhyoyaṃ Kālaṃ punyoa bhidhīyate"* |79|

In this Purāṇic verse the positions of sun and moon are mentioned in terms of the nakṣatra-pāda, namely, Sun transiting into the 3rd pāda of Viśākhā ($206^0 40'$ - 210^0) and moon at $26^0 40'$ (top of Kṛttikā-nakṣatra division) coinciding with the full moon. The epoch will be around 1700 BC and the vernal equinox will be in the 27th degree of Aries. Obviously this means the solstitial line across $116^0 40' - 296^0 40'$.

Without scientifically conceived methods it is quite unlikely that such observations as above could be recorded and transmitted across generations. In the absence of a precise technique of observation and awareness of its significance such actions would have been simply meaningless. It is evident from the above that the use of gnomons to observe the solstice was prevalent in the antiquity of the Vedas.

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[12] Bedekar, V.M. and G.B.Palsule, *Sixty Upaniṣads of the Veda*, Vol. I (1995), Motilal Banarsidass, Delhi
[13] H. Pandya, Issues in Vedic Astronomy and Astrology, Motilal Banarsidass, Delhi

5. Indradhvaja – A Remnant of Vedic Gnomon

When we place the use of gnomon against the celebration of Indradhvaja, it becomes apparent that the raising of Dhvaja or Veṇuyaṣṭi (Bamboo pole) is in fact a redundant form or a symbolic imitation of the original Vedic practice of determining the summer solstice. The astronomical dimension of the ceremony is evident from the conception of Indra as a swan in accordance with the symbolism of the constellation of Cygnus occupied by moon or Jupiter who also signified the Devas. Further corroboration to the hypothesis of astronomical origin of this festival is available in the legends related to Vāmana, who supposedly took birth on the 12th day of the bright half of Bhādrapada to vanquish the Asura king Mahābali.

Deciphering the astronomical details of the legends.

The astro-mythological characters of an allegorical description can be deciphered correctly only if we are able to precisely locate the epoch at which the allegorical legends took shape. In fact, once we are able to locate such epochs the epochs in turn throw light on the obscure and abstruse parts of the allegory. The true epoch of the aforementioned stories of Indra can be understood from the present author's work[14,15,16] on the ancient astronomical epoch of 4137 BC. In 4137 BC, three of the four cardinal points viz., the summer and winter solstices as well as the autumnal equinox were very nearly coincident with the new moon and the year had two distinctive halves respectively of 177 and 188 days when considered from the summer solstice. The astronomical features of this epoch, contained in the story of Indra, Vāmana and Bali in allegorical terms can be deciphered as follows:

Devas under the leadership of Indra represented the Vedic tradition of year-beginning at summer solstice and during the dwarfed half-year of 177 days the mid-day shadow of the gnomon increased from a value very nearly equal to zero to the length of the gnomon on the winter solstice day. This is allegorically described as the birth of a dwarf and his assumption of a huge size to vanquish the Asura Bali. The year beginning at the winter solstice i.e., the latter half of 188 days represented the Asura king Mahabali. In 4137 BC when we consider the Hindu Zodiac as Mūlādhāra Cakra, Indra and Bali respectively marked the end-points of the signs Kanyā and Kuṃbha. This fact is reflected in the caricature of Bali as the son of *Virocana* (meaning the winter Sun transiting over Śatatārakā (of 100 stars as sons) devoid of its brightness i.e., the lusterless sun of winter!). The tradition represented by Mahābali grew strong and this became Bali's ascendancy and reign as the Indra and thus arose the conflict between the Devas and Asuras. Three steps of Viṣṇu or sun to vanquish Mahābali can be identified with the summer solstice (heaven), autumnal equinox (earth) and the winter solstice (Pātāḷa) or the head of Bali himself.

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[14] Chandra Hari, 'On The Origin of Sidereal Zodiac and Astronomy', IJHS, 1998, 33(4)
[15] Chandra Hari, 'Search for an Ancient Epoch of Indian Astronomy', IJHS, 35 (2), 2000
[16] Chandra Hari, 'Date of the Solar Orbit of Śatapathabrāhmaṇa', 2000, 35(1)

Astronomy in the Caricature of Bali

The above identification of a calendar conflict as the central theme of the story of Indra, Vāmana and Bali shall find a better appreciation on having a deeper look at the astronomical details of the purāṇic caricature of Bali available in the Vāmana Purāṇa and Śāntiparva of Mahābhārata. Karaṇdikar quotes Vāmanapurāṇa and says that Vāmana had trapped Bali in two houses viz., one of the two houses of Saturn, Kuṃbha and the other of Varuṇa – the constellation of Śatatārakā. In conformity with the above link to Saturn, Bali is described as wearing an ever fresh, never fading, garland* – an allegorical description of the rings of Saturn.

In the Mahābhārata, Śāntiparva Chapter 223, sloka 5, Indra while asking Brahmā for the location of Bali, renders a very important account of the qualities of Bali:

Sa Vāyurvaruṇaścaiva sa raviḥ sa ca candramāḥ I
Sofgnistapati bhūtāni jalaṃ ca sa bhavatyuta II5II
Taṃ baliṃ nādhigacchāmi brahmannācakṣya me kaliṃ I

Vāyu, Varuṇa, Sun, Moon, Agni and water, these can be identified with the names of the deities of the various kinds of years such as Saṃvatsara, Parivatsara, Idavatsara, Idāvatsara, Anuvatasara and Vatsara and is thus supportive of the notion that Bali is a personification of calendarical phenomena. Further, the whole dialogue between Bali and Indra revolve about 'Kāla' and it ends with Indra speaking about the Uttarāyana and Dakṣiṇāyana and the last but one verse 37 of chapter 225 mentions that Indra and Bali respectively departed to the North and South directions.

Planetray Positions on the Day of Defeat of Mahābali or Vāmana Jayanti

The legend of Mahābali and Vāmana is very popular in Kerala and accordingly the birth of Vāmana and the deafeat of Mahābali took place on the 12^{th} day of the bright half of Bhādrapada. As the present author has already shown elsewhere, the summer solstice coincided with the new moon in the year 4137 BC. Obviously, in the following year (4136 BC) the summer solstice will coincide with the 11^{th} tithi of the bright half of Bhadrapada and the New Year will begin with the 12^{th} tithi. The respective planetary positions are as follows:

Summer solstice: 26 July 4136 BC 0435 UT. JD: 210955.69
Sun = 90^{0}, Moon = $213^{0}39'$

With Mūla as fiducial at 240^{0} the ayanāmśa will be roughly 60^{0}. And hence the sidereal positions of sun and moon will be $150^{0}$and $273^{0}39'$ respectively. Moon's elongation is

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* Śantiparva Ch.223.26, Bali rebukes Indra of his inability to see the garland (Divya mālā) given by Brahma.

$123^0 39'$ i.e., the 11th tithi prevailed. On the next day at 0600 IST or 0030 UT, the planetary positions are as follows:

Epoch: 27th July 4136 BC, 0600 IST. Ayanāmśa = 60^0

Planet	Tropical λ	Sidereal λ
Sun	$90^0 47'$	$150^0 47'$
Moon	$225^0 28'$	$285^0 28'$
Mars	$85^0 57'$	$145^0 57'$
Mercury	$105^0 14'$	$165^0 14'$
Jupiter	$250^0 33$	$310^0 33'$
Venus	$45^0 45'$	$105^0 45'$
Saturn	$224^0 34'$	$284^0 34'$

These planetary positions of the Year-beginning answer the intricate allegorical descriptions of the victory of Indra over Mahābali. Mark the position of moon representing the 12th tithi and Vāmana in conjunction with Saturn (representing Mahābali) on the Śṛāvaṇa constellation, which extended sidereally from 280^0 to $293^0 20'$. This conjunction of moon's phase that represented the solstice on Bhādrapada śukḷa (12), with Saturn probably received the allegorical description of Vāmana placing his feet over the head of Bali. According to the story Vāmana asked for three feet of land and Bali promised it and gifted it without heeding the advice of Śukrācārya. The position of Venus is capable of casting out all doubts about the authenticity of the above epoch as well as interpretation given to it. Venus stands in exact opposition to Saturn and Moon on the constellation of Puṣya and advised Saturn or Bali against the deed. Another interesting aspect of the positions is that the Saturn – Venus line passed midway through the signs of Makara (Capricorn) and Karkataka (Cancer) as well as bisected the arc between the equinoxes and solstices. Venus had an elongation of nearly 45^0 and was visible in the morning sky – rose at 02:19 AM LMT, at Kurukṣetra and set at 15:23 LMT – as against Saturn who rose at 03:36 LMT. The rising Saturn as such could not have given any cognizance to Venus. Moon had risen before Saturn at 14:38 LMT i.e., 45 minutes before Venus disappeared below the horizon. The most remarkable aspect of the epoch was that at the time of sunrise 0451LMT(of Kurukṣetra), the longitudes of Saturn and Moon were equal i.e., $284^0 34'$ and 285^0 respectively and thus the New Year was marked by the surpassing of Moon over Saturn.

A Critical Piece of Evidence – Bali Assuming the form of an Ass

Scholars in general approach this kind of an astronomical interpretation of an ancient legend with suspicion in view of the fact that alternate explanations may be articulated on similar lines. Many of them may even not agree that the rings of Saturn were visible to the naked eye in 4136 BC and thus may term the work simply hocus-pocus. But the legend when contrasted with the planetary positions provide us with a striking correlation between the two and a clinching evidence in support of the identification of Bali as Saturn. Mahābhārata, Śāntiparva 223.13 mentions that after the trickery played on him by the Vāmana, Bali hid himself as an ass and in 224.8 Bali himself speaks of his 'garddabha-śarīra' as contributed by the flow of time. We have noted above that Saturn

was in the middle of Makara with a longitude of 284^{0}34' and set at 0217AM. Precisely at the same moment the stars Northern Ass (γ-Cancri or Asellus borealis: Sidereal longitude = 102^{0}57' and latitude 03^{0}11') and the Southern Ass or Puṣya (δ-Cancri, Asellus australis of sidereal longitude 104^{0}08' and latitude 0^{0}05') was rising on the eastern horizon along with Venus, the preceptor of Bali. The setting Saturn or the vanquished Bali getting described in terms of the rising of the 'Donkeys' provide sound support for the fact that the legend was conceived out of the astronomical phenomena observed by the ancient people. Jupiter or Indra likewise got related to the antipodic placement of Maghā and this is reflected in the Mahābhārata Ch.224, where Bali addresses Indra as Māghavan.

Further, the planetary positions lead us to another important clue towards the decipherment of the allegory of Devāsura war. We saw above that Mahābali had two astronomical representations, viz., the winter solstice as well as Saturn respectively. Similarly, Indra also had two representations in summer solstice and Jupiter respectively. This is evident from the sidereal longitude of Jupiter 310^{0}33', which is the same as that of Deneb (α-Cygni)[*]. This led to the worship of Indra as the 'Hamsa' placed on the top of the bamboo pole.

Jupiter and Saturn Taking the Lead of Devas and Asuras

The above identification of the roles of Jupiter and Saturn leads to the possibility that the Devāsura saṃgrām might have begun with a planetary war between Jupiter and Saturn in the neighborhood of the above epoch. Surprisingly, we can find that both Jupiter and Saturn were in the same degree and hence at war on the summer solstice day of 4137 BC. The sidereal longitudes were:

Jupiter: 272^{0}47' and Saturn: 272^{0}15'. Jupiter had a south latitude of 06' while Saturn stood on the north of the ecliptic at +1^{0}05' and thus according to the classical dictum Saturn or Mahābali had victory over Jupiter (Indra). Subsequently, after a year the transit of Jupiter from Makara probably got interpreted as the victory of Devas who celebrated the year beginning on the true summer solstice day with the aid of the newly discovered instrument of gnomon. Perhaps, it was to commemorate the invention of 'Gnomon' or 'VaiṣṇvayaṣṭI' that the celebration of Indra-Dhvaja was instituted.

6. Similarity to the Legend of 'Uparicara Vasu'

We saw above the portrait of Saturn as an enemy of Indra in the legend about the Asura Mahābali. Mahābhārata's portrait of Uparicara Vasu on the other hand depicts Saturn as a friend of Indra on the following lines:

Mahābhārata Ch.63, Sloka 13-14: Indra supplicates Vasu with a Vimāna so that he can move high, over all others. This Vimāna[17] is obviously the Saturn's orbit placed above the path of all others visible to the naked sky. Śļōka 15 describes Indra's gift of

[*] α-Cygni had a sidereal longitude of 310^{0}44' in 4136 BC, provided the proper motion is assumed to be zero. Even with a few minutes of proper motion, the picture is essentially the same.

[17] Now at the time of final editing, I realize that this was a wrong interpretation. Uparicara is in fact, Cepheus as explained in a previous section.

Vaijayantimālā to Vasu – the rings of Saturn. And lastly Indra provides him with the bamboo pole and Vasu achieved prosperity by instituting the worship of Indra-Dhvaja or Indrotsava in Indra's honour. Mahābhārata account further speaks of Vasu's encounter with a mountain 'Kolāhala' who obstructed the flow of the river Śuktimatī and as a reward of the help rendered to her, Śuktimatī gifted Vasu with two of her children. Vasu married the Parvata-putri 'Girikā' (the sign Kanyā) and paved the way for the birth of a 'Matsya-twin' of 'Adrika' (same as Girika as per the meaning) viz., the Matsya Rāja and the Matsya-Kanyā. Matsya-Kanyā is a cryptic reference to the Zodiac consisting of the two halves from Meṣa to Kanyā clockwise (savya) and Mīnā to Tulā in the apasavya direction. Matsya-Rāja is probably Jupiter, the lord of the sign Mīnā.

It must be noted here that no allegory can be given a hundred percent accurate astronomical decipherment as the terminology is cryptic and the accounts being a mix up of astronomy as well as imagination. The work needs to be evaluated as a whole rather than part by part from the consistency of logic with due consideration to the fact that the planetary positions / astronomical phenomena themselves were offering clues towards deciphering the cryptic references.

7. Speculations about Kaśyapa and Aditi

Ever since the beginning of the scholarly efforts to have a grip with the astro-mythological accounts of the purāṇic literature there have been many speculations as to what really is the identity of the primordial couple Kaśyapa and Aditi, the renowned parents of Vāmana. Aditi being the deity of Puṇarvasu most of the scholars have conceived the couple in terms of the nakṣatras Punarvasu and Puṣya. This is not correct. The Taittirīya Āraṇyaka I.7-20 provide us with a clue as to the true identity of Kaśyapa in its reference to the 8th Sage Kasyapa who sticks on to the Mount Meru (North Pole). The word "Kasyapa" means 'Tortoise' i.e., with the inclusion of the 8th star probably the Great Bear got transformed into a Tortoise situated over the pole. The precession or revolution of the polar axis is very slow and akin to the movement of a tortoise and hence the above metaphorical title 'Kaśyapa' was given to the 8th Sage or Polestar. The star under reference as the 8th Sage is probably ι-Draconis which was near the pole around 4800 BC and in the subsequent centuries the pole was in the sign of Virgo, who became the legendary mother of Ādityas, the Aditi. More precisely Aditi was the Year beginning with the sign Virgo and the 12 months were the Ādityas and their father was the sign Leo who inherited the appellation Kaśyapa with the entry of solstice/pole to the sign of Leo.

The birth of Vāmana and Kṛṣṇa in the solar month of Bhādrapada or Kanyā supports this interpretation (Vasudeva and Devaki, were the reincarnation of Kaśyapa and Aditi).

8. Indra-māsa, Onam of Kerala, Intercalation at Summer Solstice

Atharvaveda V.6.4 refers to the thirteenth month as the house of Indra. Karandikar[18] has quoted Alberūṇi to throw light on the Iranian practice of calling the five intercalation days as "Ander Gah", which may be an Avestan modification of 'Indra Dina'. Surprisingly, the

[18] Karandikar, *Vedic Astronomy and Mythology*, 1978, Pune, P.63

strongest evidence for the existence of this tradition comes from Kerala, in their major celebration of 'Oṇaṃ' – which coincide with Vāmana jayanti and is being celebrated on śravaṇa nakṣatra of the solar month of Leo. In Kerala, all the celebrations are nakṣatra oriented and the importance is relatively less for tithi just as the solar months are dominant over the lunar ones. Because of such historical reasons and also due to the precessional changes now the celebration switch between the lunar months of Śrāvaṇa and Bhādrapada. Festival begins with Hasta nakṣatra and ends on the 10th day of Śravaṇa nakṣatra when Bali is said to be on a visit to see his land in lieu of a boon granted by Vāmana. The traditional customs include:

1.Making of a circular flower disc with a central projection and Veṇuyaṣṭi (Bamboo pole) in the front yard, perhaps to symbolize the Saturn's rings and the Gnomon, on all the 10 days. (Gnomon with circles around probably resembled Saturn and hence Saturn became a symbol of time).

2.People engage themselves in sham fights, probably to commemorate the Devāsura war.

3. Swing (Jhūlā) is the most popular enjoyment by flying to greater heights – really the effort is to become "Uparicara".

All these symbolic acts, especially the circular flower carpet in ring formation and the central bamboo pole are reminiscent of the astronomical basis of the festival.

9. Conclusions

While assessing the merit and validity of this work it must be remembered that the present author is not the progenitor of the symbolic links established between mythological heroes and their astronomical counterparts. Scholars like Bentley, Karandikar, Tilak, Sengupta etc., had introduced such ideas decades and even centuries before without any reference to a particular epoch. (In fact Bentley[19] had attempted astronomical interpretation of Indian mythology as early as in 1823). These works have remained more or less speculative due to the difficulty in achieving precise computational verification. Relying on many such works and Yāska's Niruktam, Purāṇic encyclopedia etc., a few articles were published by P.G.Krishnan Nair[20] in Malayāḷaṃ also in recent times. He could not give any computational evidence and had worked on the impression that the legends must have taken shape during Vedāṅga Jyotiṣa times. *It is therefore well evident that the astronomical transliteration (if I can say so) of the legend was not discovered by the present author to justify an epoch of his choice.* The Purāṇic literature itself contains sufficient details that enable one to arrive at the astronomical identity of mythological heroes with some imagination, independent of any particular epoch. But the

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[19] Bentley J., A Historical view of the Hindu Astronomy, Part-1, Asiatic Society, Calcutta. 1823

[20] Krishnan Nair PG, A number of articles in "Pragati" few years before -details of the issues not available. They contain Purāṇic references but not those of like Karandikar and Sengupta. Even Karandikar has given only poor references and so it is difficult to ascertain as to who has originally made the identification of say, Bali as Saturn, Vāmana as related to the mid-day shadow of summer solstice etc. May be the conceptions originally belong to Karandikar

true epochs when identified as above with the help of accurate modern computations, the astronomical phenomena of the epochs start throwing light even on the most obscure parts of the legends.

It is apparent from the above decipherment of the legend of Mahābali and the epoch discovered that the Vedic civilization had a flourishing phase of astronomy around the distant antiquity of 4137 BC. Use of Gnomon was prevalent and popular and the society derived much delight from astronomical observations. The astronomy based on the zodiacal signs/ constellational figures received a setback probably with the discovery of Gnomon, when people achieved the capability to precisely identify the cardinal points. Much of the Hindu mythology in fact is woven around the calendar conflicts of ancient past and the antiquity lies beyond the best of imagination of the modern historians and archaeologists.

• Evaluation at IJHS

The paper was rejected without showing any reasons. On the request of the author a referee report was communicated later that read as follows: [Author's comments are given in italics in brackets]

"1.The paper sets out to prove that "much of the Hindu mythology in fact is woven around calendar conflicts of ancient past. It begins with the hypothesis that Indradhvaja symbolized the setting up of the gnomon, but then goes on to erect a large edifice of speculation and conjecture. In the later part, every other sentence contains an unsubstantiated conjecture (see the number of times the author uses "perhaps" or similar expressions.

[*On his own the author has not created any conjecture to articulate an interpretation suited for the epoch. I have only used the past identifications by reputed scholars to identify the epoch as well as to explain the astronomical basis of the story. Author has used 'perhaps' in view of the possibility of alternate interpretations by veterans. This is one of the first studies of its kind and as such no high claim was made of the decipherment as the ultimate truth*]

2. The formation of mythology is much more complex than this paper asserts. The author's attempt to rewrite mythology as some insignificant astronomical events cannot be accepted.

[*What process may be more complex than the one by which astronomical phenomena has undergone metamorphosis as mythology, that too in a cryptic language?*]

3.Likewise the linguistic equations on which some of the conjectures are based cannot be accepted: ander gah (sic) in al-Biruni = Indra dina in Sanskrit; or that Kaśyapa means "tortoise".

[→ *Author has only quoted reputed authorities such as Karandikar. To quote Karandikar: "Al Beruni says that the five days, which were added at the end of year were called by the Parsikas as 'Ander Gah' which according to us is the same as our 'Indra-day'. In the Avesta of the Parsis, the*

Vedic Indra was pronounced as 'Ander'. 'Gah' mean 'time', 'place', 'throne', 'bed', and 'authority' in the Persian language. The meaning of the term Ander Gah is thus clear".
→ Kaśyapa: Sanskrit – English dictionary of M. Monier Williams gives the meaning Tortoise]

4. The author is careless with English throughout. P.1: "The Aryan myth has crumbled with the surfacing of Sanskrit glossary in the ruins of Indus valley civilization". What this sentence is conveys that during the excavations in Indus valley a Sanskrit glossary belonging to that period was discovered like the seals and other artifacts. But what the author means is that somebody called Natwar Jha wrote a book called Vedic Glossary on Indus seals in recent times. Or consider the expression "Astronomy in the caricature of Bali" and so on.

[*→On the contrary to what the referee says, the author in fact is skeptical of the referee's grasp of English! It was in the excavations of Indus Valley that the Sanskrit glossary was discovered in the form of numerous seals. But its true nature surfaced only with the decipherment by Dr. Jha.*
→ Caricature: Oxford dictionary gives the meaning 'comically exaggerated representation especially of a person'. When considered as a whole the profile that we find of Mahābali in the legend is not a fair portrayal suited to his stature as a Great Emperor. As I have pointed out Bali is described as to have become 'garddabha śarīra' after his defeat by the trickery of Viṣṇu, in the Mahābhārata. As such what is wrong with the use of the word caricature to describe the epic profile of Mahābali?]

5.The paper is pretentious (P.1:"History of science as created by people like D.P.Chattopadhyaya is in dire need of revision...")

[*Does the quoted observation makes the paper so pretentious or unscholarly?*]

6. The paper thus violates all norms of scholarly presentation.

- **In a rejoinder that sought a review of the rejection, author submitted:**

→Comments 1 and 2:
I have used 19 references in presenting the astronomical interpretation of mythology and the quoted authors include Prof.Sengupta and Alberuni. Quotations provided from these authors in fact are the foundation of the work.
→Comment3:
I have only quoted reputed authors. I am not a linguist and have made no attempt to invent meanings that suits my interpretation.
→Comment4:
I don't want to discuss the merit of this observation. My poor English I don't think forms a valid reason against my paper. It is to rectify such deficiencies that the editorial office is functioning.
→Can the standard of English be a criterion in deciding the suitability of the paper?
→Comment 5:
I have presented my views on the perverted history created by D.P.Chattopadhyaya in the introduction. If it is irrelevant to the paper the editor can apply his wisdom and remove it. How can it become a ground foe rejecting the paper?

Referee had based his conclusions on the five arbitrary comments given above having no relation to the ideas and astronomical interpretation attempted in the paper.

Paper -II

DATE OF KṚṢṆA AND THE MAHĀBHĀRATA WAR

Abstract

The present paper is an attempt to fix the date of Kṛṣṇa and the Mahābhārata war by deciphering the relevant astronomical details of the mythical personages and the allegory contained in the epic. Beginning with a historical introduction to the astronomical interpretation of mythology, the date of birth of Kṛṣṇa or the related astronomical epoch and the date of the Mahābhārata war has been fixed as belonging to 4136 BC and 4036 BC respectively. War diary available in the epic is shown to be an allegorical description of the observed astronomical phenomena of 4036 BC.

1. Introduction

Even though Ṛgveda is universally accepted as the oldest literature of humanity, the date of the civilization that produced it has been a subject of much discussion and controversy. Max Muller placed it around 1000 – 1200 BC while Jacobi and Tilak tried to push the antiquity farther back to 4000 BC on astronomical grounds. European scholars like Macdonell, Keith, Winternitz etc., have sided with Max Muller on the ground that *it is not safe to build a chronological edifice on a foundation the solidity of which is subject to great doubts.*[1] Modern researches spanning more than a century has attempted to examine the issue from all possible angles, but with the more and more information that have come to our hands through research as well as archaeology the confusion has only increased. The Indus or Harappan civilization is scientifically dated to 2700 – 1300 BC, but most of the scholars treat it as a different development than the Vedic civilization. When we come to the Epic like Mahābhārata the historical questions become much more complicated. It is generally construed as an anterior development despite the mention of many of the epic characters in the Ṛgveda itself. *In a nutshell, we are yet to achieve a clear definition of the chronology our ancient past despite being possessed of one of the most voluminous of literary records of the pre-historic era.* Examination of the various hypotheses on the ancient Indian chronology does not fall within the scope of this work, which is exclusively an astronomical effort to throw some light into Indian antiquity by fixing the epochs of Kṛṣṇa and the Mahābhārata War that have remained an intriguing problem of Indian history. As such in the discussion I shall constraint myself only to the serious astronomical works that have appeared in relation to this topic. One of the latest works on Vedic antiquity by Rajesh Kochhar, a professional scientist has dated the Mahābhārata war to have taken place in 856 BC and as regards the astronomical clues available in the text makes the following observations:[2]

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[1] Raychaudhuri, H. 'Studies In Indian Antiquities', p.4. University of Calcutta, 1989

[2] Kochhar, Rajesh. *The Vedic People-their History and Geography*.p.56, Orient Longman, Hyderabad, 2000

"Astronomical data in the Mahābhārata have been interpreted by a number of scholars to yield a wide spectrum of dates ranging from 3140 BC to 1151 BC. A 2000-year spread in the time bracket shows that the astronomical dating of the literary texts on the basis of stray statements in them is a highly dubious exercise. This bracket is no improvement on the dates assigned otherwise. *It is however significant that no one has ever suggested for the Bhārata battle a date very much younger than 900 BC".*

Pusalker also has expressed the same opinion on the astronomical data available in the Mahābhārata:[3]

"According to the Aihole inscription of Pulakeśin II (seventh century AD) the Bhārata War took place in 3102 BC, which is the starting point of the Kaliyuga era according to the astronomical tradition represented by Āryabhaṭa. But Fleet has pointed out that the reckoning was not found in Vedic times; it was first started about 3500 years after the time for the purposes of calculation, and was not known to astronomers before Āryabhaṭa. Another school of Hindu astronomers and historians, represented by Vṛddha-Garga, Varāhamihira and Kalhaṇa, places the Bhārata War 653 years after the Kaliyuga era, i.e. in 2449 BC. These two schools thus present conflicting views, and as they are based on a hypothetical reckoning of a late date, we can hardly attach much importance to them.

Astronomical references in the Mahābhārata itself, about the position of the Nakṣatras and planets have been utilized for determining the date of the war. But, the same data have yielded various divergent results. As a matter of fact, the statements in the Epic are conflicting and self-contradictory, so that in order to arrive at some conclusion it is necessary to reject certain statements or their implications as later interpolations or mere exaggerations. *No satisfactory and acceptable result can be arrived at from these data...."*

It is apparent from these observations and the mutually contradictory dates arrived at by reputed scholars[4]: 3140 BC, 3137 BC, 3102 BC, 3000 BC, 2449 BC[5], 1931 BC, 1400 BC, 1197 BC[6], 1151 BC, that either the astronomical records are contradictory/insufficient or our approach in interpreting the same has been deficient in some way. To any problem the wrong solutions can be innumerable and no valid inference can be drawn of the set of erroneous conjectures as above. Pusalker has therefore rightly stated that no satisfactory and acceptable result can be arrived at from these dates. Kochhar[7] on the other hand says that it is however significant that no one has ever suggested for the Bhārata battle a date very much younger than 900 BC. Kochhar's remark raises a very important question relevant to all fields of research - *Can any significant or valid inference be drawn of a set of wrong solutions?* In the above-referred astronomical solutions no scholar has given an erroneous result lower than 900 BC and none has gone beyond 3140 BC. Do this feature

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[3] Pusalker AD, Vedic Age, p.272, Bhāratīya Vidyā Bhavan, Mumbai, 1996

[4] Ibid p. 320 has the mention of related original references.

[5] Sengupta, *Ancient Indian Chronology*, pp.1-59, Pub: University of Calcutta, 1947.

[6] Daftari, KL. *The Astronomical Method and its Application to the Chronology of Ancient India*, p.13, University Office, Nagpur.

[7] Kochhar, same as (2) above.

of a set of wrong results mean anything while attempting to have a correct solution? *Does it mean that the correct result will be falling within the limits of the above set of solutions?* Similar conclusions may be right in the context of a set of solutions arrived at by examining the dynastic lists of the Purāṇas, but it cannot be so in the case of a set of contradictory results arrived at based on astronomical data.

In fact, a mutually consistent set of astronomical data must lead us to a unique result. As Pusalker says, if the astronomical data available in Mahābhārata is self-contradictory, the first step should be the identification of a *cardinally important set of observations* recorded in the Mahābhārata and a solution has to be then attempted *with due consideration to their mutual consistency*. Present author has great admiration for the excellent works by scholars like K.L.Daftari and P.C.Sengupta, who could not probably arrive at the true date of the war due to the deficiency of astronomical algorithms they had more than fifty years ago. With the advent of modern approaches and software in computational astronomy it is easy to realize that the computation of astronomical *phenomena like eclipses were less than perfect in the days of these scholars and this* might be the major source of error that has led the various scholars to arrive at mutually contradictory solutions.

In the present work, in addition to the modern computation author intend to follow a novel approach in interpreting the astronomical clues available in the Mahābhārata.

2. Continuous Tradition, But Anomalous History

One of the most important as well as distinguishing features of the history of Indian civilization according to Majumdar is its continuity spanning across the millenniums. To quote:[8]

"The chief difference between India and the other ancient countries mentioned above lies in the continuity of her history and civilization. The culture and civilization of Egypt, Sumer, Akkad, Babylon, Assyria, and Persia have long ceased to exist. They are now mere past memories and their history possesses only an academic interest. Indian history and Institutions, however, form an unbroken chain by which the past is indissolubly linked up with the present. The modern peoples of Egypt and Mesopotamia have no bond whatsoever with the civilization that flourished millennia ago and its memorials have no more (usually very much less) meaning to them than to any enlightened man in any part of the world. But not so in India. The icons discovered at Mohenjo-daro are those of gods and goddesses who are still worshipped in India, and *Hindus from the Himalayas to Cape Comorin repeat even today the Vedic hymns which were uttered on the banks of the Indus nearly four thousand years ago.* This continuity in language and literature, and in religious and social usages, is more prominent in India than even in Greece and Italy, where we can trace some continuity in history...."

Despite this continuity of tradition, when we look into the ancient history of India we in fact meet with a paradox, which Majumdar described in the following words:[9]

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[8] Majumdar, RC. *Vedic Age*, p.38, Bhāratīya Vidyā Bhavan, Mumbai. 1996

"The absence of any regular historical chronicle is the leading feature of this (ancient) period. When we consider the vast mass of contemporary literature and its extremely wide range, the almost utter lack of historical texts certainly appears as a somewhat strange phenomenon. Some people are, therefore, inclined to believe that such literature did exist, and explain its absence by a theory of wholesale destruction. It must be regarded, however, as extremely singular that the agencies of destruction should have singled out this particular branch of literature as their special target. But the strongest argument against the supposed existence of regular historical literature is the absence of any reference to historical texts. We have, therefore, to admit that the literary genius of India, so fertile and active in almost all conceivable branches of study was not applied to chronicling the records of kings and the rise and fall of states and nations. It is difficult to give a rational explanation of this deficiency, but the fact admits of no doubt.

The deficiency is all the more strange as there are indications that the ancient Indians did not lack in historical sense. This is proved by the carefully preserved lists of teachers in various Vedic texts, as well as in writings of the Buddhists, Jains and other religious sects...Even so late as the seventh century A.D. Hiuen Tsang noticed that each province in India had its own official for maintaining written records in which were mentioned good and evil events ...We may thus presume that neither historical sense nor historical material was altogether wanting in ancient India. What was lacking was either the enthusiasm or the ability to weave the scattered raw material into a critical text with a proper literary setting which the people would not willingly let die...Whatever may be the reason, the fact remains that the only concrete result of historical study in the most ancient period is to be found in long lists of kings preserved in the Puranas and the epics. These lists profess to trace the unbroken royal lines from the first human king that ruled down to about the third or fourth century A.D. The earlier part of them is obviously mythical, and the last part is undoubtedly historical; but it is a moot point to decide where the myth ends and reliable tradition begins." *(Emphasis mine)*

It is apparent from these accounts that neither the astronomical clues nor the genealogical list of the Purāṇas are reliable enough to draw any final conclusions on the Indian antiquity.

3. Nature of the Literary Evidence – Epics and Purāṇas

The epics and purāṇas – are they historical in content? What is the chronology that they present? There are no easy answers to these questions. Daftari has quoted Mahābhārata, Vāyu and Brahmāṇḍa purāṇa to prove that they are histories, but this does not solve the problem as Daftari himself does not consider the other purāṇas as consisting of history. Another difficulty lies in interpreting the statements and narrated episodes, which are apparently cryptic to the modern minds. Daftari observes:[10]

"But some objectors say that these historical works are full of absurdities and discrepancies and cannot be relied upon. This is illogical. No doubt the language of ancient books is hyperbolical and poetical. But the hyperbolical statements cannot vitiate

[9] Majumdar, RC. *Vedic Age*, pp.47-48. Bhāratīya Vidyā Bhavan, Mumbai, 1996
[10] Daftari, KL, same as (6) above p.5

the other statements that can be construed to have a rational meaning and the poetical statements have certainly some rational facts as their basis. For instance, the waiting of Bhīṣma for Uttarāyana before giving up his life voluntarily, has for its basis the fact, that though he lay wounded for 58 days he died just after the Uttarāyana began. More over it is quite possible in works written thousands of years ago, that their language has become unintelligible on account of changes in the meanings of words and such other causes, and that mistakes in the readings of text and interpolations and deletions have corrupted them..."

Along with these factors outlined by Daftari we have a far more serious problem to deal with. Let us consider the same instance as above of Bhīṣma, whom Daftari has considered as a historical personage. But when we look up into the caricature of his life available in the epic absurdity crops up. He is born of Gaṅgā, the celestial Ganges to Śantanu and has lived through almost four generations! Similar is the case with almost all personalities. Consider the case of Duryodhana and his hundred co-born or the birth of Kṛṣṇa with the insignia of Viṣṇu and the scenario of the war with many sophisticated weapons. To what extent do such unbelievable episodes contain history? For any text to be considered as providing factual/reliable information, the necessary condition is that it should not lead to absurdities. But with Mahābhārata the chronology itself is absurd and the modern researches of the last two centuries have failed to elicit any intelligible information out of the Yuga scheme contained in the epic. It is therefore apparent that *against the premise of history as we understand today, Mahābhārata as a whole can be treated only as a bundle of absurd conceptions.* For a valid interpretation of Mahābhārata and Rāmāyaṇa in the historical context or decipherment of history *we need a premise in which the whole of these epics – the legendary account of the lunar and solar dynasties – ceases to be absurd.*

In fact only astronomy is capable of providing such a premise. When we look upon the epics as an astronomical history of the pre-historic world couched in allegory, the cryptic episodes allow elucidation and whatever defies our understanding can be credited to the factors outlined by Daftari (Quoted above). To elaborate a bit:

(a) See that it was the sun and moon who founded the dynasties that have become popular in the Epics.

(b) Kuru-vaṃśa had its orgin from 'Chhāya' who gave birth to 'Tapati' who is popular as a river or celestial stream. From Tapati → Saṃvaraṇa →Kuru →Pratīpa → Śantanu, who married the celestial Ganges and thus Bhīṣma, was born.

(c) If we examine the ancestry of Satyavati, there also her father Uparicara Vasu – the king of Chedi is of celestial origin and he governed the country by remaining onboard his Vimāna.

(d) Have a look at the progenitors of the Pāṇḍavas: Yama, Vāyu, Indra, Aśvinis. Can we imagine that Kṛṣṇadvaipāyana Vyāsa could have allowed so much of imagination in

writing out the Itihāsa of his times? A look into the epic throws many such odd terminologies before us that won't make any sense in an earthly context.

(e) Birth of almost all characters like Karṇa, Pāñcālī, Dhṛṣṭadyumna, Dṛoṇa etc., do not allow the possibility of being historical personages. If we accept the epic characters as historical Personages, then we will have to do so with Viṣṇu having his abode over the Milky Way and others like Kaśyapa, Aditi, Rudra, Durga etc.

(f) Lastly, how can the Avtars of Viṣṇu be considered as historical personages without ascertaining the basis of the chronology attached to them?

Endless instances can be quoted to illustrate that the major episodes of Mahābhārata are not compatible with the happenings of an earthly world and as such the characters do not represent the historical personages. All the characters are of astronomical attributes and the language of the epic is allegorical. It contains history in terms of astronomical epochs couched under mythology which have become cryptic due to loss of the relevant information in the scores of centuries that have passed since the original conception and the paradigm shifts that have occurred in human thinking and living conditions.

4. Astronomical Identification of Mythical Personages

The task of finding out the astronomical identity of mythical personages involves two major steps:

• (a) Qualitative ideas about the related astronomical epochs can be gleaned from the festivals and sacred days observed by the Hindus. It is possible that precession might have made many of the sacred days to loss their true astronomical rationales. We can overcome this difficulty by accounting the precessional effect. These festivals and sacred days were an integral part of the Tāntric religion that prevailed in pre-historic times.

(b) Mythological profile of epic characters when contrasted with the Indian as well as western constellational / stellar mythology yields important clues towards the astronomical aspects involved.

•• The second step is to prove the inferences drawn above by appropriate astronomical computations.

Ascribing astronomical identity to Hindu mythological characters is nothing new to the researches into Indian antiquity. As early as in 1823, John Bentley in his essay "A Historical View of the Hindu Astronomy, from the earliest dawn of that science in India, down to the present time" Part-I had identified some of the major characters of Hindu mythology with astronomical phenomena. Bentley considered Serpent as the emblem of the year and the ecliptic and has made the following observation in the context of the nakṣatras:[11]

[11] Bentley John, A Historical View of the Hindu Astronomy, from the earliest dawn of that science in India, Down to the present time" Part-I, p.6

"It now remains to be explained the principle on which the months were formed and named, and the time to which they refer. I have already observed that the Lunar Mansions were fabled by the Hindu poets to have been married to the Moon, and that the first offspring of that poetic union were four of the planets. In like manner, the Hindu poets feign, that the twelve months sprung from the same union, each month deriving its name, in the form of a Patronymic, from the Lunar Mansions in which the Moon was supposed to be full at the time".

Also he identifies Durgā as follows:

"The commencement of the year with the month Āśvina, of all others, was the most celebrated: Durgā, the year, personified in a female form, and goddess of nature, was then feigned to spring into existence. In the year 1181 BC, the first of Āśvina coincided with the ninth day of the moon; and on that day her festival was celebrated with the utmost pomp and grandeur. In the year 945 BC some further observations were made, by which they determined, that in 247 years and one month, the solstices fell back $3^0 20'$ in respect of the fixed stars...This goddess, properly speaking, signifies the year: she is therefore the goddess of nature; she is the consort of Śiva, (the personification of time in the male form); she is the same as JUNO of the Greeks and Romans..."

Further, Bentley has equated: Brahmā →Time, Viṣṇu →Time, Vāsuki →Year, Ananta →Eternal time, Śrī or Lakṣmī →Luni-solar year/ Moon, Kaustubha →Sun, Surabhī, Pārijāta, and Dhanvantari →Year etc., and has computed the epoch at which the legend of Lakṣmi (as born on the 30th of Āśvina on Lakṣmīvāra or Thursday) originated by giving an astronomical interpretation to the episode of churning the Kṣīrasāgara or Milky Way by the Devas and Asuras. But unfortunately the astronomical data he had was not of the required accuracy and as such he could not arrive at a correct solution.

The above approach of Bentley is neither a strange nor an isolated attempt by an eccentric individual. Many others like Karandikar have shared similar views about Purāṇic episodes. The present author had quite independently the same conclusions about the churning of the milky ocean before coming to know about Bentley's rare work. It is therefore apparent that the mythological descriptions tend to convey an irresistible astronomical appeal to the discerning individuals.

5. Date of Birth of Lord Kṛṣṇa

An authentic version of Kṛṣṇa's purāṇic horoscope with the planetary positions could not be ascertained from any modern source. Details of planetary positions etc. are not available in either the Bhāgavatapurāṇa or Mahābhārata. In the Bhāgavatapurāṇa Xth Book, IIIrd Chapter Kṛṣṇa is said to have born on the nakṣatra of 'Prajāpatī', which is usually taken to mean as Rohiṇī. Viṣṇupurāṇa I.26 (5) suggests 8th day of the dark half of Śrāvaṇa while Harivaṃśa gives:

"Aṣṭamyāṃ Śrāvaṇemāse Kṛṣṇapakṣe mahātithou I
Rohiṇyāmardharātre ..."

i.e., spells out the time specifically as at midnight. But there is some discrepancy in these accounts as some people consider Bhādrapada Kṛṣṇāṣṭamī as marking the birth anniversary of Kṛṣṇa. Svāmi Harṣānanda[12] has ascribed such divergent opinions to older traditions. Bentley being not satisfied with the accounts in purāṇas and Harivaṃśa could lay hands upon a horoscope the reference of which he has not given. Definitely the chart must be of traditional origin obtained from some reliable source for other wise Bentley would not have taken it up for his study. The verse quoted is little confusing in respect of planetary positions:[13]

"...Kṛṣṇa was born on the 23rd day of the Moon of Śrāvaṇa, in the lunar mansion Rohiṇī, at midnight; at which instant the moon, mars, mercury and Saturn were in their houses of exaltation; the moon in Taurus, mars in Aries, Mercury in Virgo and Saturn in Libra; that the sign Taurus was then rising: Jupiter in Pisces, the sun in Leo, Venus and the moon's ascending lord in Libra".

For these details Bentley had computed the epoch as 7th of August 600 AD having Jupiter in Taurus as per the European tropical Zodiac.

In any inquiry of this sort going back to quite early times, the question of Zodiac shall naturally crop up. In the above result arrived at by Bentley not only that the Jupiter's position is different but also the sun occupying the 17th degree of Leo had no significance as an epoch so that it got personified. I have already shown in my previous works[14] the possibility of the existence of sidereal zodiac viz., "Mūlādhāra Rāhu-Śikhi Cakra" in pre-historic times and the evolvement of Hindu mythology with reference to the related celestial events and calendar conflicts. The fiducial star Mūla and the Rāśi Dhanu got personified as Mahākāla or Śiva while the Rāśi Virgo became the Durgā in the Tāntric or Śaivāgama tradition in 4137 BC. At the same epoch the Vaiṣṇava mythology got woven around the then pole star, ι-Draconis and the sign Leo as Kaśyapa while Virgo became the Mother of all Gods, Aditi. In a paper under submission[15] it has been shown that the legend of Upendra or Vāmana defeating Mahābali developed with the epoch of 4136 BC, with summer solstice and the sign Virgo* or Aditi, at the beginning of the year. In fact, Kaśyapa means a tortoise – one of the Avtars of Viṣṇu. Matsya and Varāha also probably arose out of the stellar configurations of Ursae Major, Draconis and Ursae Minor. Peter

[12] Harṣānanda, Hindu Festivals and Sacred Days, Ramakrishna Math, Bangalore-19

[13] Bentley John, A Historical View of the Hindu Astronomy, from the earliest dawn of that science in India, Down to the present time" Part-I, pp.10 –11

[14] Chandra Hari, 'On The Origin of Sidereal Zodiac and Astronomy', IJHS, 1998, **33**(4)

[15] Previously discussed paper: 'Indradhvaja – A Pointer towards Vedic Antiquity'.

* This Virgo beginning of the year is still prevalent in Kerala – the land created by the Bhṛgus or Bhārgava mythologically. Based on the Keralite legends that the Kollam Era is the Paraśurāma era devoid of the thousands, Bentley has fixed the date of Paraśurāma to be 1176 BC. He had no evidence to include more than a thousand in his conception. But when we are able to take back the origin of astronomy and zodiac to 4000 BC, it won't be that irrational to add another three thousand to reach around 4000 BC as the epoch of Paraśurāma. As his name Bhārgava suggests astronomically he is Venus or Śukra.

Lum's description of the Dragon reminds us of the dance of Kṛṣṇa over the head of serpent Kāḷiya:[16]

"The Dragon is certainly a remarkably twisted constellation and it is one which is not so well known as it should be. The tail of the monster lies between the Great and lesser Bears, his body coils itself with many a star-strewn loop around three sides of the Little Bear and then twists back until a triangle of star forms a wicked-looking, pointed head just below the foot of Hercules..."

It is quite likely that the legend of Hercules arose out of the astro-mythological profile of Kṛṣṇa and Kāḷiya is the Dragon without much of a doubt. Kāḷiya's abode is Yamuna, an allegorical term that implies a co-born of Yama. Kāḷiya may have etymological links with the term Kāla also, which stands for Yama and obviously the story had its origin related to the polar stars of Draconis viz., ι and α-Draconis. *The legends about Nahūṣa add credence to the above identification. Nahūṣa is the grand father of Yadu, the progenitor of the Yādavas. Nahūṣa by penance (like Dhruva) became Indra or the pole star, which correspond to the position of summer solstice over the ecliptic. Nahūṣa's reign as Indra and his ride over the Seven-sages to meet Indrāṇi is another related astro-mythological legend. Nahūṣa uttered 'sarpa', 'sarpa' to speed up the Sages and received the curse of Aṅgiras to become a Sarpa or serpent (Dragon). This legend in fact refers to the reign of one of the stars of Draco as the Polestar and its subsequent fall. Reference to Nahūṣa can be found in the Ṛgveda itself and is reflective of the antiquity of the astronomical observations by the Vedic Ṛṣis. Note the cryptic astronomical clue 'Sarpa' that appears in the allegory to stand for the Draco.*

Another clinching evidence for the fact that the story of Kṛṣṇa is an astronomical allegory is available in the reference towards the 'Kadaṃbā' tree from which Kṛṣṇa jumped over Kāḷiya, who had his residence below. 'Kadaṃbā' is a well-known astronomical term, meaning - the pole of the ecliptic and thus provides a reassurance for the inference drawn above. It is apparent from these instances that the allegories were framed out of astronomical observations over a long period and this was possible only in a very advanced society. Also we can understand that these legends would not have taken place during the reign of present Dhruva or Polaris of Ursae Minor and *any reference to a previous pole star obviously takes us to the pre-historic domain of history.*

Prevalence of Zodiac and astronomy cannot therefore be doubted in the pre-historic phase of our civilization. Against the backdrop of the above analysis if archaeology becomes a hurdle to believe in the existence of an advanced civilization that could give rise to these legends around 4000 BC, then perhaps the problem lies with archaeology rather than with the present thesis. With this background of ideas, we shall now pass on to the fixing of the epoch of Kṛṣṇa.

Kṛṣṇa Epoch

Astronomically, the Śṛāvaṇa – Bhādrapada dispute regarding Janmāṣṭamī is a clue towards the fact that the tradition had its beginning around the time when the solstice was

[16] Peter Lum, The Stars in our Heaven, Thames and Hudson, London.pp.22-29

at the junction of the signs Leo and Virgo. Mythologically, the legends about the conflict with Indra-another son of Aditi and also the rain god suggest that the original Kṛṣṇa divested of the mythological attributes that he might have gained through the scores of centuries, is an year beginning coinciding with the summer solstice at the beginning of Kanyā. With a bit of astronomical labor his horoscope can be located as per the sidereal zodiac and as such he had his "astronomical birth" in the summer solstice of 4135 BC i.e. on 26 July 4135 BC, 00:15 IST, at Mathura, JD = 211320.28125[φ]. On considering the solstice as marking the boundary of Leo and Virgo/ Kaśyapa and Aditi, the planets (grahas) were in the following sidereal signs. Sun in Simha just before the solstice, Moon in Rohini, Venus in Tulā, Saturn in Makara, Jupiter in Mīna, Mars in Meṣa along with Rāhu. Note that the positions match with the legendary beliefs about the horoscope of Kṛṣṇa as having all Planets in own houses or exaltation signs.

Planetary Positions

Jupit.	Mars Rāhu	Lagna Moon	
	Rāśi		
Sat.			Sun
		Venus Śikhi	Merc

Planet	Longitudes		Rāśi
	Tropical	Sidereal	
Sun	89°21'	149°21'	Simha
Moon	349°04'	49°04'	Vṛṣabh
Mars	322°29'	222°9'	Meṣa
Mercury	112°44'	172°44'	Kanyā
Jupiter	291°20'	351°20'	Mīna
Venus	121°31'	181°31'	Tulā
Saturn	237°38'	297°38'	Makara
Rāhu	318°56'	18°56'	Meṣa

At the midnight before the New Year beginning, at Mathura, the Mṛgaśīrṣa nakṣatra was rising on the east with moon on the rear at Rohinī [*] and became the character Kṛṣṇa and the Zodiac became Sudarśana Cakra in mythology. *Perhaps the planetary ruler ship over the Rāśis was decided at this epoch. Note the placement of Mars, Venus, Mercury, Saturn and Jupiter. The Rāśis in which they are placed and the "sammukha" rāśis belong to them, in the zodiac or astrological symbolism, which we have come to inherit. The only left over in the above scheme was Kaṭaka, which was given to moon. Further note the placement of planets on both sides of Moon: On the west the superior planets Mars, Jupiter and Saturn are placed along with Rāhu in the same order as they appear in the Vimśottari daśa scheme while on the east the inferior planets have associated with the descending node Śikhi – and this configuration of planets is an exact replica of what we see in the Vimsottari scheme of astrology. This fact alone provides sufficient justification for the fact that the Epoch of Kṛṣṇa marks the formulation of astrological* zodiac as Rāhu – Śikhi Cakra.

[φ] TT correspond to 211321.87375 and $\Delta T = 51192$ seconds.

[*] Rohiṇī is Surabhi, the divine cow and thus Kṛṣṇa became Gopāla.

In the thousands of years that followed the original conception of Kṛṣṇa might have grown around other celestial happenings and the astronomy itself did loose its shape and as such the story as available in Bhāgavata purāna or Mahābhārata cannot be wholly deciphered astronomically. The above planetary positions have been calculated with the latest algorithms of modern astronomy (Bureau des longitudes, Paris) and its authenticity is beyond doubt. *If the doubt persists still have a look at the position of Rāhu in the second pāda of Bharaṇī – the clinching evidence I have to present is the Rāhu's name "Bharaṇī-bhū" i.e., when the Rāhu-Śikhi Cakra was conceived Rāhu was born in Bharaṇī nakṣatra.* This name of Rāhu is available on page 747 of the Sanskrit-English dictionary of M. Monier Williams.

It must be noted here that this horoscope is contemporaneous with the progenitor of Yādava clan Nahūṣa (ι-Draconis) and his reign as Indra since 4800 BC. By 4135 BC, there must have been a shift in his position from the pole and thus originated the story of Kṛṣṇa dancing over Kāḷiya or Draco.

Astronomical Significance of the Bhādrapada Epoch

Other than Kṛṣṇa we have got many other characters taking their birth in Bhādrapada, such as Balabhadra (on śukḷa dvitīyā), Varāha (on śukḷa tritīyā), Kalki (on śukḷa dvādaśi) and Gaṇapati on Śukḷa caturtī. As the tithi of summer solstice shifted by nearly 11 every year, we can locate the respective year beginnings in the neighborhood of 'Kṛṣṇa'. We can comprehend the reasons behind the sacredness of Janmāṣṭamī as representing an epoch, but what about the other ones Śukḷa 2,3,4 and 12 becoming sacred? Another important aspect is the sacredness of these tithis belonging to other months as well. What inspired the ancient people to make these days immortal as mythological characters? It is possible that some of the sacred days may be of later origin, but the Bhādrapada element can be certainly traced to the antiquity under discussion and so an explanation has to be sought for the practice.

In fact, we have got a precise astronomical reason. At the Kṛṣṇa epoch the half-year from summer solstice to winter solstice had only 178 days or almost 6 lunar months only. As a consequence Bhādrapada, Āśvina, Kārttikā, Mārgaśīrṣa, Pauṣa, Māgha and Phālguna solar months had their beginning on the same tithi and thus the Kanyā year beginning and the respective tithi had more significance than usual in their calendar. In the year 4137 BC, all these months had their beginning with Śukḷa (1), followed by Śukḷa (12) in 4136 BC and so on*. *Kṛṣṇa achieved special significance in mythology because he had wielded the Sudarśana Cakra i.e., the sidereal Zodiac with all the planets in a rare position that highlighted their lordships.*

Adjective 'Bhadra' A Clue Towards Decipherment

We saw above the terms such as *Sarpa* and *Kadaṃba,* which offered clues towards understanding the astronomical links contained in the allegorical episodes. In fact in the

*The major periods in which intercalations were made are: 19 years after which the tithis reapeated; 40 years at which the Kṛṣṇa (8) marked the above month beginnings. 80 years corresponding to Śukḷa (15). 120 years after the Śukḷa (8) and at 160 years. the return of amāvāsyas.

absence of the term *Sarpa* it is difficult to identify convincingly the Nahūṣa with the constellation of Draco. Similarly, we can find terms with clear astronomical identity like *Kārkoṭakā, Ṛtuparṇa, Kali, and Dvāpara* etc. in the Naḷopākhyāna of Mahābhārata, which point towards the allegorical aspect of the episodes. Similarly, the term *Bhadra* is of great implications in understanding the astronomy underlying a major part of mythology. It signifies the sign Kanyā as for example in *Bhadrakāḷī, Balabhadra, Subhadra* etc. Kāḷī can dispel any doubt as may arise regarding the validity of the hypothesized link between these mythological characters and time or year. In fact Bentley in explanation of the decipherment he had attempted did point towards this fundamental feature of Hindu religious conception. He has remarked that 'All the Hindus are Saturnalians, that is, worshippers of time, under various shapes and names, according to the different sects'.[16]

The epoch of Balabhadra –mythologically the avtar of Ananta or Śeṣa - can be precisely identified as the summer solstice of 4145 BC i.e., 26 July 4145 which coincided with Bhādrapada śukḷa dvitīyā (JD =207668.512). Further it is interesting to note that one of the variants of Durgāṣṭamī, the Bhādrapada śukḷāṣṭamī is also known as Rādhāṣṭamī, *after the legendary gopikā* of Vṛndāvan, who was dear to Kṛṣṇa. Bhādrapada śukḷāṣṭamī has moon at Jyeṣṭa Rohiṇī, the second Surabhi, and thus became Gopālikā in the legends.

Subhadra

Subhadra's identity with Kanyā may not be disputed. But still it may be better to supplement the identification with a proof. *The sign Kanyā is owned by Mercury or Saumya (the son of Moon) and Kanyā when descended on earth as Subhadra, the son of Moon himself descended to earth as her son Abhimanyu.* Can we describe this as a simple coincidence? Does this not prove that the author of Mahābhārata was well aware of the astrological symbolism behind Kanyā rāśi?

Paule Lerner has identified Subhadra as Citra star. Subhadra, getting married to Arjuna or Phalguna probably is an allegorical reference to the winter season constituted by the months of Phālguna and Caitra. The term *bhadra* also means - Dakṣiṇa from which the name of Dākṣāyaṇī evolved for Durgā-Kanyā; Mount Meru, which justifies the link assumed with Kaśyapa; Meru has got a daughter by name Bhadra married to Bhadraśva; and lastly it means an elephant as well as a Bull or Buffalo. The last of the names gave rise to the legends Mahiṣāsura and Mahiṣī, the Asura conception of calendar with which the Devas were in incessant conflict.

6. Evolution of Mahābhārata and Nature of Astronomical References

As pointed out by erstwhile scholars, Mahābhārata, the world's biggest epic, had its origin in the form of gāthā nāraśaṃsīs i.e., songs of heroes. The opening verse:

Nārāyaṇaṃ namskṛtya naraṃ caiva narottamaṃ I
Devīṃ Sarasvatīṃ Vyāsaṃ tato Jayamudīrayet II

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[16] John Bentley, "A Historical View of the Hindu Astronomy, from the earliest dawn of that science in India, Down to the present time" Part-I

And Ādiparva I.1.102:

Caturviṃśati sahasrīṃ cakre Bhārata-samhitām I
Upākhyānairvinā tāvad Bhāratam procyate Buddhaih II

These verses are suggestive of the evolution through scores of centuries from 24000 verses or even less to the Śatasāhasrī Saṃhitā extant at least since the days of Śarvanātha of the Khoch copperplate inscription of the Gupta year 214 or AD 534. According to Sengupta, compilation in its modern form might have taken place around 400 BC and the astronomical references point towards 2449 BC to be the Year of War and Kṛṣṇa was born on 21 July 2501 BC. In arriving at these results he had taken recourse to many assumptions:

Sengupta's Assumptions [17]

1.Kṛṣṇa's horoscope is a pure invention by an astrologer of times much later than 400 AD.

2.Nakṣatras in these references mean most probably single stars or star-groups.*

3.Mahābhārata V.142.18:

Saptamāccāpi divasādāmāvāsyair bhaviṣyati I
Saṃgrāmo yujjyatāṃ tasyām tāmāhuḥ Śakra-devatāṃ II

This verse taken from the speech of Kṛṣṇa to Karṇa at the end of his unsuccessful peace mission to the Kaurava court, is interpreted to mean that before the battle (of course by 7 days) there was a new-moon near the star Antares or Jyeṣṭhā of which the presiding deity is Indra. Further, he has taken Amāvāsya to mean "Invisibility of moon" rather than the popular meaning of the 30th tithi.

4.Bhīṣma's death and winter solstice is taken as on Māgha Kṛṣṇāṣṭamī to suite his interpretations, quite contradictive of what is popularly accepted and devoid of any confusion.

5. Astronomical data of Chapter 143 of Udyogaparva and Chapter 3 of Bhīṣmaparva, was not taken into account, considering them as "mere astrological effusions of bad omens; they are also inconsistent in themselves..."

On a deeper level, by taking into account the planetary positions and Vedāṅga Jyotiṣa K.L.Daftari[18] has dated the War to have taken place in 1198 BC. A criticism of Daftari's

[17] Sengupta, *Ancient Indian Chronology*, pp.1-59, Pub: University of Calcutta, 1947

*Sengupta has also mentioned the following details: "In later times of the Vedāṅgas there are indeed recognized 27 nakṣatras of equal space into which the ecliptic was divided, but we do not know the exact point from which this division was begun. It is therefore safer to take the nakṣatras to mean stars or star gropus in this connection".

[18] Daftari, KL. *The Astronomical Method and its Application to the Chronology of Ancient India*, p.13, University Office, Nagpur

interpretations and scores of dates by other scholars are available in the work of Kuppaṇṇa Śāstri, T.S. [Collected Papers, pp.319-327. Or, Viśveśvarānand Indological Journal, Vol.XIV, 1976, pp.48-56]

Fallacy of Different Interpretations

How is that the various scholars are able to date a single event differently from a set of astronomical data? Either the data may not be that deterministic as it should be– as for example may be a humbug arising out of different epochs -or the statements containing the data may be confusing or cryptic and allows for being interpreted differently. A glance over the data is reflective of the cardinal aspects that guided the various scholars and the limitations of their methods.

• Firstly, None of these scholars or their times had a sufficiently accurate tool for the accurate computation of the eclipses of antiquity and all of them considered Mahābhārata as a historical account of events. No effort was made to differentiate the mythology from the history. Does it conform to common sense that Bhīṣma or Kṛṣṇa and many others as depicted in the Mahābhārata are historical personages? If we are able to accept their super human caricatures as poetical, what prevents us from looking at the text as an astronomical allegory? As I have mentioned earlier, to achieve a factual interpretation we need to open the text against a premise that won't lead to absurdities.

• Secondly, Scholars did not give sufficient cognizance for the fact the 'War-diary' commencing with the new moon (interpreted to have coincided with Antares) and ending at the winter solstice is a 'T-shirt' like celestial phenomena that matches with many epochs in the absence of the clinching eclipse records. As such in the absence of an accurate software no one could have determined the date of the Bhārata War correctly, albeit some extra stroke of good luck.

• Thirdly, Indian chronology as extant today is absurd due to the incomprehensible expanse of the Yugas. Daftari had done admirable work half-a-century ago, but no body had followed it up to achieve a sufficient definition for the periods such as Kalpa, Yuga etc.

7. A New Approach to the Interpretation of Mahābhārata

Present author intends to examine the astronomical clues available in the Mahābhārata under an altogether different frame of thinking based on the following cardinal aspects:

1. Mahābhārata is fundamentally an astronomical allegory, which originated in the pre-historic past. In fact, many of the characters have their counter parts in the Vedas and identification can be achieved by the use of Niruktam and Brāhmaṇa literature, as was done by Srī. P.G.Krishnan Nair of Kerala. Notwithstanding a detailed identification of the characters and the decipherment of the allegory, the date of the war can be ascertained satisfactorily from the rare occurrence of the eclipses referred to in the Mahābhārata, provided, the War theatre was the sky of Kurukṣetra.

2. A consistent set of astronomical observations needs to be identified from the whole lot of 'humbug' astronomical references.

3. No cognizance will be given to the established notions of history or earlier works on the date of the Mahābhārata War or any other notions that may create a bias.

8. Astronomical Clues and their Interpretation – A Critical War Diary

1. The most crucial of the astronomical events referred to in the Mahābhārata are the two eclipses, lunar eclipse and solar eclipse that appeared in succession at Kurukṣetra or in the latitude of 30^0N around the time of the war i.e. near about the autumnal equinox*. This will be the primary indicator of the Epoch. No cognizance to the exaggerations such as eclipses has happened on 13^{th} tithi etc.

2. Given the rarity of the above event, any such epoch has a good probability to be the Year of the War. Of course there is some chance involved owing to the fact that an earlier or later observation might have got incorporated. So if such an year does not conform to the war diary, the planetary positions may be judicially referred to locate the war events.

3. Leaving all the confusing statements aside the following unambiguous references may be chosen to form a War Calendar.

(a) War beginning: Mahābhārata V.142.18:

> Saptamāccāpi divasādāmāvāsyair bhaviṣyati I
> Saṃgrāmo yujjyatāṃ tasyām tāmāhuḥ Śakra-devatāṃ II

The present author is neither inclined to subscribe others interpretation nor to impose an interpretation on the *day of Śakra-Devata*. Let the other events answer this point. *But it is evident beyond any speck of doubt that the War-beginning had to be on an amāvāsyā.*

(b) 10^{th} day of the war ended with the fall of Bhīṣma.

Mahābhārata Bhīṣmaparva, Ch.119.96-97, speaks of his wait for Uttarāyana on the Śaraśayya (bed of arrows). The following events must be specially noted:

- Gaṅgā, described as the daughter of Himavat sends Maharṣis in the form of *Hamsa*.
- In verse 105, Bhīṣma announces to the swans departing to the south that he will return to his original abode only with the advent of Uttarāyana.
- Ch.120. 55-58, Bhīṣma refuses to take any treatment from the *Vaidyāḥ*, who came to attend him.
- Arjuna provided him water by use of *parjanyāstra* and Pillow with the arrows; He did not accept the normal ones provided.

(c) Break after the fall of Bhīṣma
Bhīṣmaparva, Ch.119.112-113:

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* Bhīṣma's death on the winter solstice day coinciding with Māgha śuklāṣṭami. 58 days after his fall and 68 days after the beginning of the war on amāvāsya, gives a unique identity to the war beginning.

Viṣādāśca ciramkālamatiṣṭan viśatendriyāh I
Dadhyamścaiva mahārājana yuddhedadhuremanaḥ II

Whether this can be interpreted to mean a break in the war has to be answered by the other astronomical events connected with the war.

(d) Balabhadra's return and the18th day war
Śalyaparva 33.5:

Catvārimśadahānyadya dve ca me niḥsṛtasyabhavai I
Puṣyeṇa saṃprayātosmi Śṛavaṇe punarāgataḥ I
Śiṣyayorvai gadāyuddhaṃ draṣṭukāmosmi Mādhava II

Balabhadra had set off for the pilgrimage on Puṣya nakṣatra and returned on the day of mace dual after 42 days on Śṛavaṇa nakṣatra. In this connection we may also note:
Śalyaparva 32.14:

Rouhiṇeyegate śūre puṣyeṇa Madhusūdanaḥ I
Pāṇḍaveyānpuraskṛtya yayāvabhimukhaḥ kurūn II

After the departure of Balarāma under puṣya, Madhusūdana in favor of the Pāṇḍavas proceeded against the Kauravas. Both the above verses together may mean that Kṛṣṇa and Balabhadra left Dvārakā on the same day of Puṣya.

(e) Bhīṣma's death, Śānti parvaḥ:

Nivṛttamātretvayane uttarevai Divākare I
Samāveśayadātmānamātmanyeva samāhitaḥ II 47.3 II

Śukḷapkṣasyacāṣṭamyāṃ māghamāsasya Pārtḥiva I
Pṛājāpatye ca nakṣatre madhyaṃ prāpte Divākare II 47.64 II

Anuśāsna parvaḥ:

Āganthavyaṃ ca bhavatā samaye mama Pārtḥiva I
Vinivṛtte Dinakare pṛvṛttecottarāyaṇe II 152.10 II

Aṣṭapañcāśataṃ rātryaḥ śayānasyādya me gatāḥ I
Śareṣu niśitāgreṣu yatḥā varṣa śataṃ tatḥā II 153.27 II

Māgho yaṃ samanuprāpto māsaḥ puṇyo Yudḥiṣṭiraḥ I
Tribhāgaśeṣaḥ pakṣo yaṃ śukḷobhavitumarhati II 153.28 II

These verses without any ambiguity[19] convey the fact that Bhīṣma's death took place 58 nights after his fall on the 10th day of the war. The new moon referred to by Kṛṣṇa and the

[19] Only exception is the Kṛṣṇa's statement in Śānti parvaḥ 51.14:
Pañcāśataṃ ṣaṭca Kurupravīra, Śeṣaṃ dinānāṃ tava Jīvitasya I

beginning of the war as such was 68 days before the winter solstice. All other details are secondary and of less significance and are prone to errors, additions/omissions, having passed through the imagination of innumerable people in describing a catastrophic war with all possible exaggerations. Thus the most cardinal of astronomical indications relating to the date of the war that can be gleaned from the text are:

•War began on an Amāvāsya, 68 days before the winter solstice. (Or, if we accept the statement credited to Kṛṣṇa the number of intervening days =66)

•Bhīṣma fell on the 10^{th} day of war

•Bhīṣma was on the bed of arrows for 58 days before the winter solstice

•Śravaṇa nakṣatra prevailed on the 18^{th} day of war

•Round about this time there was a lunar eclipse followed by a solar eclipse visible at Kurukṣetra.

9. Year of the Bhārata War

Against the above background the problem of dating the war becomes exclusively astronomical. But despite the availability of modern software, the problem of locating the eclipses are fraught with the danger when we go back into antiquity. Due to changes in the speed of earth's rotation, computations of 1000 BC or beyond may be that accurate as it should be. Moreover there are chances of duplication i.e., there might be more than one epoch answering to the above epochal features. Under such circumstances how can the veracity of a particular answer be ascertained? We have to look for other substantiating features in the Epic. This is the approach I have taken in fixing the date of the war.

Relevant Astronomical Data of the Year 4036 BC

1.Lunar eclipse: Full moon on 1^{st} November 14:29 UT. JD =247578.10331219[21]. (Wednesday night1959 IST) Moon was very close to Ārdra (Betelgeuse or α-Orionis of sidereal longitude $64^0 10'$).

2. Solar eclipse: New moon on 15 November 02:23 UT. JD =247592.59913048[22] (Thursday, 0753 IST). This eclipse happened on the nakṣatra of Abhijit (Vega).

Tataḥ śubhaiḥ karmaphalodayaistvaṃ sameṣyase Bhīṣma vimucya dehaṃ II
According to this verse, Kṛṣṇa tells Bhīṣma that you have now only 56 days more to live, and as such, the war had its beginning 66 days before the winter solstice.

[21] Tropical longitude of sun =$189^0 09'$.On the sidereal zodiac considered as Mūlādhāra Cakra, ayanāṃśa = $58^0 40'$, and the sidereal longitude = $247^0 49'$. Moon = $67^0 49'$ i.e very close to Ārdra.

[22] Tropical longitude of sun =$203^0 58'$;and the sidereal longitude = $262^0 38'$. i.e., very close to Abhijīt (Vega or α- Lyrae of sidereal longitude $260^0 44'$).

3. Winter solstice: 19 January 4035 BC, 18:00 UT, JD = 247658.25[23].

Intervening days between winter solstice and the Amāvāsya = 65.65. Number of tithis will be =66.68 or nearly 67. If we allow for the possible errors in fixing the solstice, the amāvāsya and the eclipses satisfy the War calendar quite satisfactorily. War began on 1st November when the sun rose above horizon along with Abhijit or Vega. Other important events of the calendar will be:

4. 25th November, 10th day of the war: At sunset sun was sidereally at 273°08' while moon on Kārttika at 28°42' and tithi was śukḷa (10).

5. 18th day of the war in the normal course must have been on 2nd December i.e., on Maghā / Pūrvaphālguni, in contradiction to what is stated in the ecliptic that the War ended on Śravaṇa nakṣatra. If this has to be correct we have to assume a respite in the war after the fall of Bhīṣma.

Then the course of the war would have been:

6. Droṇa begins the war again on 06th December at sunrise, when the moon was in Citrā and tithi the 22nd. Sun had a sidereal longitude of 283°50' and was on Śravaṇa. He fought for five days, upto 10th and then Karṇa succeeded as Senāpati on the 16th day war of December 11.

7.18th day war was on 13th December, when moon had its transit over Uttarāṣāḍhā during daytime and Śravaṇa at night. At sunset moon had a sidereal longitude of 276°16' and was just 1° west of Altair. Sun was at the end of Śravaṇa (291°28'), over the Delphinus.

Thus the War came to an end on amāvāsyā falling over Śravaṇa nakṣatra and Bhīṣma had a span of 37.25 days left for the Uttarāyana to begin. Bhīṣma's death must be on 20th January, Monday coinciding with Śukḷāṣṭamī on Rohiṇl nakṣatra. On 2nd November, the day was Puṣya and upto 13th December there were 42 days and this meets the condition raised by Balabhadra's pilgrimage. Further, it must be noted that the Bhīṣma's account of 58 nights and Kṛṣṇa's account of 56 days are both correct if we take the former as tithis and the latter as days.

10. Astro-Mythological Validation of the Epoch

The year 4036 BC thus satisfies the main astronomical requirements of the War Epoch as described in the Mahābhārata. A host of other references relating to planetary positions are not in agreement with this epoch. Under such a circumstance no claim of infallibility is possible and we need to look for alternate grounds to establish the 4036 BC as the epoch of Bhārata War. More over the established notions of history and archaeology do not permit the placement of Bhārata War at the distant antiquity of 4036 BC. Against this predicament, we can raise sufficient supporting evidence from a most unexpected corner viz., astro-mythology, provided we are able to transcend the

[23] Tropical sun =270°00', moon = 341°10' and tithi = 5.93. Moon's sidereal longitude = 39°50' i.e., just entering the division of Rohiṇī at 23:30 IST.

established notions like there might have been only primitive cultures or nomadic tribes in 4036 BC. To arrive at the truth we do not need any pre-conception that the zodiacal signs were not known in pre-historic India. For first hand information on the 'astro-mythological' dimension of the Mahābhārata the only popular reference available is the Paule Lerner's work, "Astrological Key in Mahābhārata".[23] It can be referred to by the skeptics to tide over the bias if any against the proposition that Mahābhārata depicts an astronomical allegory. An exhaustive account of the astronomical basis of myhology is beyond the scope of this paper and as such the effort will be to focus only on the issues that have a relevance to the War episode of Mahābhārata.

Zodiacal Symbolism Apparent in the Episodes of Mahâbhārata

P.G.Krishnan Nair[24] in his Malayālaṃ articles has given a detailed account of the correspondence between Bhārata episodes and those of the Vedas along with the relevant astronomical connections. Present author has also shown in an earlier work that Bhīṣma or Gaṅgādatta is a symbolic character representing the fiducial star Mūla, which marks the beginning of Dhanu rāśi over the zodiac.Śantanu is Sūrya and Bhīṣma is Gaṅgādatta as Mūla is at the point where Ākāśa Gaṅga cuts the ecliptic. In the epic he represented the Mārgaśīrṣādi calendar/Dhanu rāśi and was also the grandsire of the clan of Satyavati or *Matsya-Kanyā*, which obviously is a cryptic reference to the Zodiac. The symbolism of Dhanu and Mithuna rāśis again appears in the story of Pāṇḍu shooting an arrow over the mating antelopes*. In 4137 BC, the autumnal equinox coincided with Mūla and the other cardinal points formed the junction points of the rāśis Kuṃbha - Mīna, Vṛṣabha - Mithuna and Siṃha - Kanyā. This configuration in fact formed the foundation of many astro-mythological characterization. The details of the story of Uparicara Vasu and the Matsya-Kanyā Adrikā have been explained elsewhere. On similar lines, King of Virāṭa or Matsya Rāja is the personified Mīna rāśi and this is evident from the Kṛṣṇa's departure on Revati from Virāṭa to Hastinapura as indicated in Udyogaparva 81.7.Revati portrayed as the wife of Balabhadra, Virāṭaputri Uttara, who becomes the wife of Abhimanyu are all constellations rather than any happenings on earth. In the Virāṭa parvaḥ 39.14, Arjuna speaks of his birth as follows:

> Uttarābhyāṃ ca pūrvābhyāṃ phalgunībhyāmahaṃ divā I
> Jāto himavataḥ pṛṣṭe tena maṃ phalgunaṃ viduḥ II

Arjuna, the original conception arose out of the winter solstice[∇] (Himavataḥ pṛṣṭe: here the reference to south pole just as the mount Meru represents the north pole and summer

[23] Paule Lerner, Astrological Key in Mahābharata, Motilal Banarsidass, Delhi, 1988.
[24] Krishnan Nair. PG. A number of articles in malayālaṃ, 'Pragati', Calicut
* Mating antelopes: Ṛṣi who assumed the form of Mṛga: Ṛṣis means the stars is evident from the evolution of the term Saptarṣis from Saptarkṣayaḥ meaning 'seven shining ones'. Not only Mṛga but Hamsa also appear as Ṛṣis in Mahābhārata due to this reason. Dhanu rāśi is also the basis of the legends of Śiva as Pinākapānī and Kirātamūrthy.
[∇] 20 January 4132 BC. 04:34 UT. Sun = 270^0 and Moon = $89^0 14'$. Ayanāmśa, nearly 60^0.

solstice) that coincided with Pourṇamī on the junction of the phālgunis. In fact we can find

a number of characters representing the same phenomenon appearing in various episodes. As for example, Kṛṣṇa may be identified withSun and Bhādrapada and Arjuna with Moon and Phālguna, Bhīma with Māgha etc. We may not be right in expecting a logical rigor in the characterization of pre-historic times and we may not succeed in recreating the calendar features of those ancient people from the extant legends.

Nair has given a detailed account as to how the northern India and the various cities like Dvāraka, Hastinapura, Indraprastḥa and Matḥura were depicted on the zodiacal belt using the clues available in Mahābhārata and Vedic literature. As for example, to understand the connotation of the word Dvāraka or Dvāravati we must know as to how the root 'dvāra' is defined in the Mahābhārata. *Udyogaparva Chapters 108-111, describes the various directions and calls them, as the 'dvāra' -s of Sun. Dvāravatí there becomes the city of Sun allegorically, and is one of the many appellations of ecliptic available in the epic.* Similarly, to understand the secret of Candravaṃśa it is necessary to know, whom the Candra referred to is and where is his location. Udyogaparva 111.8 speaks of Candra as coroneted in the North where the Ākāśa Gaṅga falls over Rudra i.e., the rāśi Dhanu is referred to here. Once Candra the progenitor is located it is easy to locate the Hastinapuram also known as Nāgapuraṃ and Gajapuraṃ in the epic. The constellation that is described as an elephant's tusk is Pūrvāṣāḍḥā occupying the central part of Dhanu rāśi and thus originated the capital named after Hasti. In the Sabhāparva chapter 11, we meet with the description of Brahmasabhā or Brahmapuraṃ as placed even above the *Svarga* (north pole) and outshining even the sun and moon. This in fact is an allegorical description of the placement of Abhijit in the northern most latitude of $61^{0}44'$ in Dhanu rāśi.

Another important aspect that formed the basis of the allegory was the division/ allocation of ṛtus among the deities. As for example, Yāska's Niruktam presents the following scheme:[25]

Deities	Ṛtus	Worlds
Agni	Vasantam, Sarad	Pṛthvī
Indra	Grīṣmaṃ, Hemantaṃ	Antaīkṣaṃ
Āditya	Varṣa, Śiśiraṃ	Svargaṃ

In the absence of proper intercalations, conflicts could have arisen as regards the various domains in terms of lunar months. For example, the seasons were conceived differently as 5 / 6 in number and the cycle could be conceived either from the solstices or

[25] Yāska. Niruktam, VII.8-10, p. 118, Motilal Banarsidass. 1998

equinoxes. The following figure shows the various domains with respect to the epoch of 4137 BC, wherein the cardinal points coincided with the sidereal sign boundaries.

Śiśira Mīna Āditya	Śiśira Meṣa Āditya	Vasanthartu Vṛṣabha Agni	Vasantha Mithuna Agni
Hemanta Kuṃbha Indra	4137BC-Seasonal cycle beginning with solstices		Grīṣmakalam Kaṭaka Indra
Hemanta Makara Indra			Grīṣma Simha Indra
Śaradkālaṃ Dhanu Agni	Śaradkālaṃ Vṛścikā Agni	Varṣa Tulā Āditya	Varṣa ṛtu Kanyā Āditya

On the other hand if the seasonal cycle is considered from either of the equinoxes or if the number of seasons are taken as five the deities will have different domains, the boundaries of Devas and Asuras will differ and obviously there will be enough scope for conflicts and celestial Wars (between personified constellations, signs and planets). Mahābhārata in fact describes such a 'Calendar Conflict' of 4036 BC i.e., a hundred years after the Kṛṣṇa epoch. According to the legendary curse of Gāndhāri, the Kṛṣṇa epoch had to end after 36 years, that is, in 4000 BC, after 135 years. Purāṇic Encyclopedia has quoted Bhāgavatapurāṇa and Pratisarga saṃhita to put the longevity of Kṛṣṇa at 125 and 135 respectively.

With the above background of ideas the Bhārata war that took place between 15 November and 13th December 4036 BC can be understood as an astro-mythological war of the heavens.

11. War Calendar vis-à-vis the Constellational Belt

Astronomical data discussed are with reference to the latitude of New Delhi and the standard meridian of India.

1.War beginning on 15 November

The most notable feature of 15 November 4036 BC is the appearance of Abhijit or Vega on the horizon slightly before sunrise. Abhijit in fact means "Victorious" and as such reflects the title "Jaya" of the epic. Further, III.134.14 describe the Mahābharata as saptatantrī vīṇā (seven stringed Lyre), which when combined with the opening verse is reflective of the original form of Mahābhārata as a song of victory. The Lyre from which the song had its origin is α-Lyrae, the Abhijit.

New moon occurred 66 solar days or 68 lunar days west of the equinox as demanded by the War diary. Mars was heliacally set on Pūrvāṣāḍhā while Jupiter and Saturn occupied respectively Maghā and Puṇarvasu. It was probably at this epoch that Mars received the

appellation Āṣāḍhabhū and Saturn became Cchāyāsuta being placed in conjunction with earth in the shadow of Moon. According to Mahābhārata the amāvāsyā took place on a day of 'Śakradevata' and this will be appropriate if the term 'Śakradevata' can be interpreted to mean Brahmadeva, the presiding deity of Abhijit. On page 285 of his work R.H. Allen has quoted Max Mueller to say that it was under the influence of Abhijit that the Gods had vanquished the Asuras.

The position of Mars as stated in the epic, Bhīṣmaparva III.18: *Brahmarṣiṃ samāvṛtya Lohitāngo vyavastitaḥ* is remarkably correct.

2. Bhīṣma's fall on 25th November

Vega continued to be present in the eastern sky. At the time of sunset, Moon was on the first pāda of Kṛttikā while sun occupied the middle of Uttarāṣāḍhā. Each of the Āṣāḍhās is figured as Elephant's Tusk but both taken together forms a bed – and obviously in the sign of Dhanu it becomes a bed of arrows over which Bhīṣma waited for the solstice. The events that followed were also astronomical in content:

▪Gaṅgā, described as the daughter of Himavat sends Maharṣis in the form of *Hamsa* – here the reference is to the constellation of Cygnus, the Swan.

▪ In verse 105, Bhīṣma announces to the swans departing to the south that he will return to his original abode only with the advent of Uttarāyana.

▪Ch.120. 55-58, Bhīṣma refuses to take any treatment from the *Vaidyāḥ* , who came to attend him. The Bhiṣaks referred to are of the Śatabhiṣak nakṣatra in the Kuṃbha rāśi.

▪Arjuna provided him water by use of *parjanyāstra* and Pillow with the arrows; He did not accept the normal ones provided. Here the reference is to Ākāśa Gaṅga and the various stars of Sagittarius, which are conceived as arrows.

3. Droṇa as Senāpati during 6th to 10th December

Moon was at the middle of Citra while Sun was in the 2nd pāda of Śṛavaṇa. Droṇa means a raven or crow (p.503) and such is reflective of the sun's transit over the constellation Aquilae – which the western mythology considers as a vulture. Nair has given a detailed account of the symbolism inherent in the 5-days of war by Droṇa. On the 14th-day war the troops were arranged by combining the Śakaṭa and Padma Vyūhas to protect the Sindhu king Jayadrathạ. According to Nair the Sindhu refers to the celestial Ganges while the saindhava king Jayadrathạ represented the Aurigae constellation and moon was on the constellation of Anurādha. In fact Nair had guessed the constellation of 14th day war to be Anurādha by deciphering the mythology rather than by any computation. The present work substantiates his guess as the 14th-day war on 09 December 4036 BC had moon in the Anurādha nakṣatra, opposite the nakṣatras Rohiṇi (Śakaṭa) and Ārdra (Padmaṃ).

4. Last Days of War on 11th, 12th and 13th December

By 11th December Sun was in the 3rd pāda of Śṛvaṇa and Śṛvaṇa itself imparted the name Karṇa – meaning ear – to the General. Śalya and Aśvatthāman succeeded Karṇa on the 18th day of War when the sun was in the 22nd degree of Makara over the Delphinis, but in the Śṛavaṇa nakṣatra. On this last day, Moon had completed a synodic revolution and was an amāvāsya on Śṛavaṇa. Śṛavaṇa has the name "Aśvattha" and the three stars of Śṛavaṇa constituted the arrow shot at Parīkṣit. See the description of R.H.Allen:[26]

"With β and γ it constituted the 21st nakṣatra Śṛavaṇa, the Ear, and probably was at first so drawn, although also known as Śṛoṇa, Lame, or as Aśvattha, the Sacred Fig Tree, Viṣṇu being regent of the asterism; these stars representing the Three Footsteps with which that God strode through the heavens, a Trident being the symbol".

The term "Aśvattha" means - 'under which the horses stand' –perhaps here the reference is to Sagittarius considered as a horse/horse-man. We can find the arrow that struck Parīkṣit on the opposite side of the sky in Cancer, γ and δ Cancri, figured as an arrowhead. Also the Fig tree or Aśvattha represents Puṣya and this confirms the above identification of Aśvatthāman's arrow with Puṣya.

12. Change over from 28 to 27 Nakṣatras - Astronomical Cause of the War

A deeper look at the course of the and sun and moon during the lunation in which the war took place i.e., the lunar transit between Abhijit to Abhijit and then to Śṛavaṇa suggests origin of the war episode in the effort to establish the 27 nakṣatra division in place of the 28 starred zodiacal belt over which Abhijit had prominence. In the 28-Nakṣatra scheme, the divisions were unequal and Abhijit nakṣatra of about 4^0 (9 muhūrtas) had its place between the present Uttarāṣāḍhā and Śṛavaṇa (Taittirīya Bṛāhmaṇa I.5.2 refers to Abhijit as *conferring victory* and situated above Āṣāḍhā and below Śṛoṇa). In the transformation from 28 to 27, Śṛavaṇa or Aśvattha obviously had a claim for Abhijit and this is represented by the character Aśvatthāman, son of Drona born with the "maṇi" or the bright star Vega over his head. The 27-nakṣatra Zodiac of course is the Sudarśana Cakra, the mythological birth horoscope of Kṛṣṇa given on page 7. In achieving this mathematical conception of equal divisions, like Abhijit, a few other stars also might have lost their place or role as the Yogatāra and thus the seed of the original conflict was probably born. Paule Lerner, even though having no idea about the astronomical war calendar presented here in, could guess rightly the 'astro-mythological' circumstances of the last conflagration created by Aśvatthāman from the reference to the nakṣatra Śṛavaṇa. To quote:[27]

"...Now, it is precisely in this celestial region that is found the constellation of Abhijit, the 28th constellation which is "sacrificed" when the tropical zodiac, which begins with the vernal point, necessitated a distribution of but 27 constellations, in order that these coincide with the signs".

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[26] Allen, RH. Star Names, Their Lore and Meaning, Dover, 1963.p.59

[27] Paule Lerner, Astrological Key in Mahābharata, Motilal Banarsidass, Delhi. 1988.p.174

Lerner had only little idea about the antiquity of the lunar zodiac of 27 nakṣatras and so she has placed the epoch of the celestial drama at the dawn of the equinoctial age of Pisces, around the time of Christ. She has not given any specific epoch for the celestial events. *In fact the introduction of the new Zodiac had begun in the year 4137 BC and Abhijit had to be discarded to make the cardinal points to coincide with the boundaries of stellar quarters and Rāśis.* Probably the conflict with the earlier tradition continued for many years and the modifications were finally accepted in 4036 BC. The respective victory found an allegorical description in the celestial events of November – December 4036 BC.

We receive a strong support for these conjectures from the fact that Mars, who bears the name Bharadvāja (ancestor of Aśvatthāman), had a longitudinal conjunction with Abhijit (*Brahmarṣiṃ samāvṛtya Lohitāngo vyavastitaḥ*) at the beginning of the war and was over Śravaṇa (Altair) at the end of the war, even though invisible being heliacally set. Similarly, mercury became visible on Śraviṣṭhā after being heliacally set and received the name Śraviṣṭhāja.

28 Equal Divisions of 12°51'25.71" versus **27 Equals of 13°20'**

Because of the uneven placement of the yogatāras it is quite likely that the zodiac had unequal divisions in the earliest conception. If we suppose that there were efforts to introduce 28 equal divisions from Abhijit and / 27 equal divisions from Mūla, then a very interesting picture emerges. Taking the Mūlādhāra Cakra as the reference for longitudes the celestial conflict can be visualized as follows:

Abhijit yogatāra being at 260°44' of the Mūlādhāra Cakra, the first few divisions springing from Abhijit would have been Abhijit (260°44'-273°35'), Aśvatthā (273°35'-286°27') and Śraviṣṭhā (286°27- 299°18). In the 28-scheme all these nakṣatras had their yogatāras, but in the 27-scheme from Mūla there was no Abhijit and the latter ones had to forsake their stars Altair and the α and β-Delphinis. In the same way the two schemes had different nomenclature of lunar months based on the star at which the full moon appeared. In the Abhijit scheme When Bhīṣma had his fall on 25th November at the time of sunset sun was precisely at the end of Abhijit and moon was at Kṛttikā, wherein we can find Ambā (the principal star Alcyone), the mythological Kāśirājaputṛi who reappeared as Śikhaṇḍi to take vengeance upon Bhīṣma. After Bhīṣma's fall there was a break till sun reached the end of Aśvatthā (of the 28-scheme) and the War continued for 8 days upto the sun's transit over the Delphinis (Śraviṣṭhā of the 28-scheme). Against this background we can understand the friendship of Karṇa with Duryodhana in the celestial placement of Śravaṇa and Āśleṣa. With the 27-nakṣatra Zodiac, Karṇa lost his possessions and failed to protect the kingdom of Duryodhana who is Āśleṣa, antipode of Śravaṇa, in view of the fact that the lunar months received their names from the successive full moons at Puṣya, Maghā, Uttaraphālguni, Citra etc., instead of the full moons at Āśleṣa, Pūrvaphālguni, Hastha, Svātī etc., in the Abhijit scheme. Above all the Rāśicakra, conception of Kālacakra that came into being in 4135 BC with the birth of Kṛṣṇa had to eliminate the Abhijit system to protect the rāśis and nakṣatras which were defined with reference to Mūla and the cardinal points. Kṛṣṇa as such became the Charioteer, Sun, for Arjuna who symbolized the winter solstice coinciding with Phālguni pourṇami. The Mṛgaśīrṣa nakṣatra, which rose at Mathurā on the midnight of 25/26 July4135 BC, had the apogee

(one of the apex of orbital velocity) of sun coinciding with it in 4036 BC and thus the mythological characterization as a Charioteer is remarkably appropriate.

Mahābhārata, Vanaparva 230:8-11, speaks of the fall of Abhijit and the filling up of the gap by Kṛttikās etc.

Abhijitspardhamanā tu Rohiṇyā kanyasī svasā I
Icchantī Jyeṣṭhatāṃ devī tapastaptuṃ vanaṃ gatāḥ II

Tatra mūḍhosmi bhadraṃ te nakṣatraṃ gaganātcyutaṃ I
Kālaṃ tvimuṃ paraṃ Skanda Brahmaṇā saha cintaya II

Dhaniṣṭhādistadā kālo Brahmaṇā parinirmitaḥ I
Rohiṇyo$f$bhavatpūrvamevaṃ saṃkhyā samābhavat II

Evamuktetu Śakreṇa tridivaṃ Kṛttikā gatāḥ I
Nakṣatraṃ saptaśīrṣābhaṃ bhāti tadvahnidaivataṃ II

Generally these verses receive the interpretation that the fall of equinox on Kṛttikā had brought the prominence to Kṛttikā in place of Rohiṇī. But the mention of Agni as the deity of Kṛttikā in verse 11 suggests the beginning of Vasantha (having Agni as the deity) with Kṛttikā or the month of Jyeṣṭhā and the respective epoch will be 1700 years before the fall of equinox, that is, around 4000 BC. Dhaniṣṭhā achieved significance when Vasantha began with the month of Caitra and Śiśira with the month of Māgha and Dhaniṣṭhā. Rohiṇī would have marked the beginning of Vasantha, when the vernal equinox would have been in Ārdra or Puṇarvasu around 5000 BC. The star β-Tauri probably received the name Agni, when it marked the beginning of Vasantha around 6000 BC. This is not some thing improbable as Tilak had advocated an antiquity of 6000 BC to the astronomical references in the Ṛgveda.

13. Antiquity of Vedic Astronomy

Kṛttikās themselves offer a crucial evidence to establish the prevalence of astronomical observations around 6000 BC in India. Kṛttikās numbering seven have the individual names such as Abhṛayantī, Meghayantī, Varṣayantī etc., which are suggestive of rainfall in the month of Kārttikā. In fact there is no other sensible explanation for these names, which unambiguously speak of rains. Further we can find Indra, the rain god, as the deity of Jyeṣṭhā or Antares placed in Vṛścikā and this is a pointer towards the fall of summer solstice. Umāpāda Sen has referred to the fall of summer solstice over Antares in the following words:[28]

"In Ṛgveda V.31.11 sun's chariot is retarded, its motion is not visible, it is stationary for a time and takes an eastward course. Sun's movement over solstical and equinoctial points are alluded to in numerous verses, but this factor remains to be carefully noted that whenever a solstice or equinox was alluded to allegorically or metaphorically, INDRA was invariably connected with such an episode. The matter is of supreme importance as it

[28] Umapada Sen, The Ṛgvedic Era, p.55, Firma KLM, Calcutta, 1974.

offers clue that the Nakshatra Indra (afterwards Jyeṣṭha Rohiṇī, the Jyeṣṭhāgni, finally Jyeṣṭha over which Indra is a presiding deity in later periods but who represented it originally) always bore some sort of connection with solstices and equinoxes...."

In addition, we can find in Vedic literature references to the location of winter solstice in Aśvini (α,β Arietis) and a detailed account of the respective calendar is available in the paper, "A Search for the Earliest Vedic Calendar" by K.D. Abhayankar.[29] Abhayankar has placed the Aśvinī calendar based on sidereal revolutions of Sun, Moon and Venus (intercalation) at an antiquity of 7000 BC.

14. Riddle of Purāṇic Chronology

The greatest hurdle in having a realistic perception of Indian antiquity is the absurd purāṇic chronology consisting of incomprehensibly large expanses of time known as Yugas borrowed from the Siddhāntic astronomy. Integral multiples of 432000 years has no role to play in human history and none sensible may subscribe to such notions – a freak that evolved in a dark age, perhaps in some attempt to recreate the lost chronology of the pre-deluge phase of the Vedic civilization. Daftari has attempted to decipher the true chronology, the real configuration of the Kalpa – Manvantara – Yuga cycles, by relying on the Vedic references to their durations.

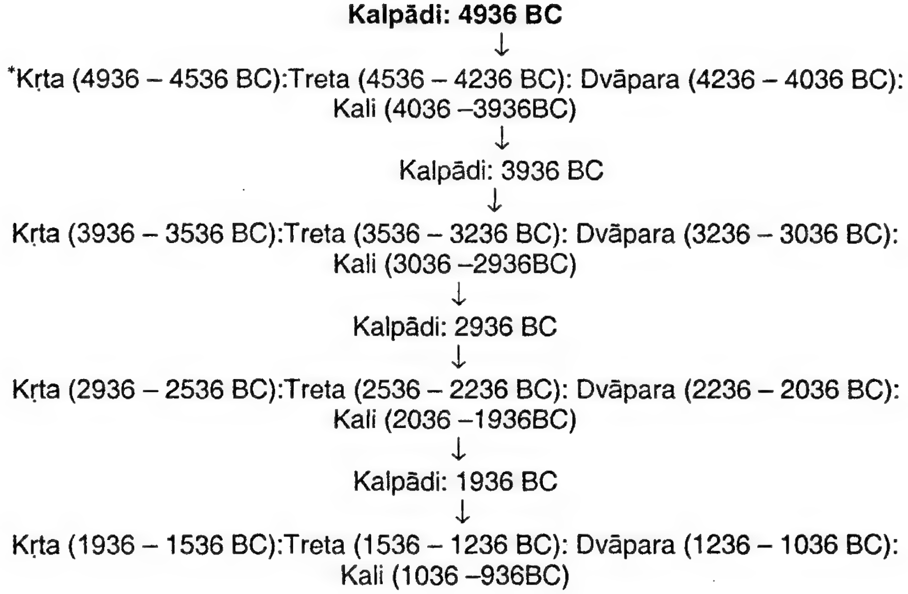
According to Daftari[30] originally, the Yuga meant the cycle of intercalation and the Śathapathabrāhmaṇa suggests intercalation after a period of four years with a long year of 381 days in which the Aśvamedha was performed. This four-year Yuga was prevalent before the five-year yugas of Vedāṅga Jyotiṣa. Daftari goes on to quote the Purāṇas to show that the Vaivasvata and Cākṣuṣa manvantara were each of 68 yugas of 272 years and a Kalpa originally meant a period of 1000 years in which the equinoxes / solstices receded by one nakṣatra. As such the Kṛta, Tretā, Dvāpara and Kali might have been of 400, 300, 200 and 100 years respectively. Indian antiquity therefore is constituted of different Kalpas and Kṛtādi yugas and the extant description of the epochs such as Rāma, Kṛṣṇa etc., do not have sufficient information as to facilitate a unique identification. Daftari has worked out the chronology further by adopting his War year 1197 BC as the basis and accordingly 3102 BC marked the beginning of Varāha Kalpa rather than the Kaliyuga as is postulated by the siddhāntic texts.

What is of interest to us in the above is that many of the original epochs of Indian antiquity might have undergone disfiguration with the siddhāntic scheme of astronomical yugas and what we know as Kaliyugādi from the siddhantic astronomy in reality may be something different. Kali-Dvāpara sandhi of Bhārata War can very well be 4036 BC and accordingly we may conceive the Indian chronology as:

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[29] Abhayankar, KD. *A Search for the Earliest Vedic Calendar*, pp.255-272, Issues in Vedic Astronomy and Astrology, Motilal Banarsidass, 1992.

[30] Daftari, KL. *The Astronomical Method and its Application to the Chronology of Ancient India*, pp.131-193, University Office, Nagpur



Kalpādi: 4936 BC

↓

*Kṛta (4936 – 4536 BC):Treta (4536 – 4236 BC): Dvāpara (4236 – 4036 BC): Kali (4036 –3936BC)

↓

Kalpādi: 3936 BC

↓

Kṛta (3936 – 3536 BC):Treta (3536 – 3236 BC): Dvāpara (3236 – 3036 BC): Kali (3036 –2936BC)

↓

Kalpādi: 2936 BC

↓

Kṛta (2936 – 2536 BC):Treta (2536 – 2236 BC): Dvāpara (2236 – 2036 BC): Kali (2036 –1936BC)

↓

Kalpādi: 1936 BC

↓

Kṛta (1936 – 1536 BC):Treta (1536 – 1236 BC): Dvāpara (1236 – 1036 BC): Kali (1036 –936BC)

It is apparent from the above that the Dvāpara – Kali sandhi associated with the Bhārata War cannot be identified on the basis of Purāṇic Yuga scheme. On the other hand the astronomical data of the Mahābhārata viz., the two eclipses visible at Kurukṣetra, the new moon and War beginning on Abhijit at 68 days (exactly) prior to the winter solstice, allegorical characterization of Bhīṣma, Droṇa, Aśvatthāmā etc., all point towards 4036 BC as the main epoch under reference in the War episode. Kṛṣṇa epoch at 4136 BC and the respective planetary positions provide indirect substantiation to the interpretation attempted in this paper.

15. Planetary Astronomy in Pre-historic Times

Present author is well aware of the difficulties in accepting that the planetary astronomy existed in India in pre-historic times such as say 2000 or 4000 BC. As such to drive the point more forcefully I would like to quote another remarkable record of ancient planetary positions from the work of Daftari:[31]

Vāyupurāṇa Chapter 53:

Vivsvānaditeḥ putraḥ sūryovaicākṣuṣe tare I
Viśākhāsu samutpannaḥ grahāṇaṃ prathamograhaḥ II 104 II

*Kṛtayugādi: According to Mahābhārata, Vanaparva 190.90. Kṛtayuga begins when the Sun, Moon andJupiter are in conjunction in the Rāśi of Puṣya. As per this criterion the aforesaid Kṛtayugas had their beginnings at: June 19, 3941BC; June 18, 2945 BC; June 16, 1949 BC and 04 July 952 BC.

[31] Ibid, pp.205-207

Tvişiman dharmaputrastu somo viśvavasustathā I
Śāntharaśmiḥ samutpannaḥ Kṛttikāsu niśākaraḥ II 105 II

Ṣodaśārcibhṛgoḥ putraḥ śukraḥ sūryādanantaram I
Tāragrahāṇām pravaraḥ tiṣyakṣetre samutthitaḥ II 106 II

Grahścāṅgirasaḥ putrodvādaśācirbṛhaspatiḥ I
Phalgunīṣu samutpannaḥ sarvāsu ca jagadguruḥ II 107 II

Navācirlohitāṅgastu prajāpatisutograhaḥ I
Āṣāḍhāsvihā pūrvāsu samutpanna iti śrutiḥ II 108 II

Revatīṣveva saptacirsthatā sauraḥ śanaicaraḥ I
Revatīṣu samutpannou grahou candrārkamardanou II 108 II

The passage implies that at the time of the Cākṣuṣa Manu, the planets were born in the following nakṣatras: Sun: Viśākha, Moon: Kṛttikā, Venus: Tiṣya ?, Jupiter: Phālguni, Mars: Pūrvāṣāḍhā, Saturn: Revati and Rāhu: Revati. Daftari could compute the epoch from these positions and the relevant data as per the latest astronomical algorithms are as follows:

Cākṣuṣa Epoch: 8th October 2422 BC, Full moon at 1302 IST, Tuesday, JD: 837067.813646

Planet	Longitudes		Nakṣatra
	Tropical	Sidereal	
Sun	$175^0 31'$	$212^0 06'$	Viśākha
Moon	$356^0 40'$	$31^0 5'$	Kṛttikā
Mars	$223^0 45'$	$260^0 20'$	P.Āṣāḍhā
Mercury	$196^0 48'$	$233^0 23'$	Jyeṣṭhā
Jupiter	$114^0 38$	$151^0 13'$	U.Phālguni
Venus	$152^0 21'$	$188^0 56'$	Svāti
Saturn	$321^0 46$	$358^0 21'$	Revati
Rāhu	$303^0 29'$	$340^0 04'$	U.Bhadra

Here the nakṣatra/sidereal positions have been calculated as per the Mūlādhāra Cakra with an ayanāmśa of $36^0 35'$ and the positions are in remarkable agreement with Vāyupurāṇā. It must be noted that even the position of Rāhu could be ascertained in 2422 BC with considerable accuracy. The position of Venus is not that clear from the verse and perhaps we may take Tiṣya as the synonym of Svāti. Another remarkable aspect is that Moon had a northern latitude of $04^0 06'$ and rose on that day in conjunction with Kṛttikā (Alcyone: $35^0 24'$, Latitude:$04^0 03'$) at 18:19 IST on 30^0 N with the longitude of $35^0 54'$ and latitude $04^0 14'$. It is therefore apparent that the rising moon had occulted Alcyone (η-Tauri) and the epochal observation was recorded meticulously along with the positions of other planets.

In the light of this evidence there are no reasons to suspect the origin of planetary astronomy and zodiac in India in pre-historic times such as 4000 BC. There might be some historical reasons behind the disappearance of Rāśis and Rāhu-Śikhi Cakraṃ from the later records. The deluge that happened around 3102 BC may be the principal cause that destroyed the old chronological and astronomical records.

16. Conclusions

In this paper my effort has been to prove the existence of a well-developed school of astronomy in Vedic antiquity and to date two of the most important events viz., Birth of Kṛṣṇa and the Bhārata War. Contrary to the traditional approach of treating the epic descriptions as of earthly events, here the epic has been considered as an astronomical allegory. Epoch of Kṛṣṇa has been identified as the summer solstice of 4135 BC and the midnight of 26th July at Mathura fully agrees with the traditional beliefs about Kṛṣṇa's horoscope. Further, relying on the epic reference to the lunar and solar eclipses taking place on the successive full moon and new moon the 'Bharata War' epoch has been determined as 15 November 4036 BC. Astronomical phenomena of this epoch have been shown to be the basis of the allegorical war description available in the epic.

Evaluation at IJHS

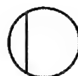
Referee's Comments: "I personally feel that the author has tried to see allegory in astronomical references for which there is no place in serious astronomical studies and there is no tradition dating the Mahābhārata war in 4136 BC suggested by the author. I am therefore personally of the view that such an article has no place in a serious scientific publication as IJHS".

Author's Rejoinder:

• What constitutes a referee report – someone's personal view or an objective evaluation of the contents of the submitted paper?

In 10 point letters my paper runs into 22 pages and has systematically dealt with the topic and the referee report is a 4-line personal opinion – *Do this qualify as a referee report in a "serious scientific publication as IJHS"?*

• *A tradition of dating the war in 4136 BC is necessary for the validity of my paper?* It's a shame that the man who wrote this referee report consider himself as a scientist!



Appendix - I

India - Original Home of the Zodiac?

1. Recent Expositions on Ancient Mysteries

Since the appearance of Erich von Däniken's 'Chariots of the Gods?' in 1968, a spate of speculative works dealing with the 'Ancient Mysteries and Civilizations' has followed in the last three decades. The latest best sellers of the series are:

- The Orion Mystery: Robert Bauval and Adrian Gilbert [1994]
- Fingerprints of the Gods: Graham Hancock [1995]
- The Message of the Sphinx: Graham Hancock [1996]
- Heaven's Mirror: Graham Hancock and Santha Faiia [1998]

These works profess a prehistoric civilization of great antiquity such as 10500 BC primarily based on astronomical evidences relating to the stellar patterns apparent in the Pyramids of Giza and temples of Angkor Wat. According to Bauval the three Pyramids of Giza viewed in relation to Nile depicts the relative positions of the constellation Orion and the Milky Way as existed in 10450 BC - more than seven millenniums before their generally accepted archaeological dating of the Pyramids. Quite appealing as it is the treatment of the subject by the authors anybody is led to believe them without much of a suspicion and doubt till one comes across a critical examination of the evidences presented by Bauval and Gilbert. Historians and authors on prehistory and archaeology Peter James and Dr. Nick Thorpe have made a thorough scrutiny of the various such amazing claims that have appeared during the last few decades in their work 'Ancient Mysteries' [1999] and challenges a major part of the speculative findings of Bauval about the correlations between the stars of Orion and the Pyramids of Giza. The scourge of Atlantis attributed to Plato has sought to mystify the corridors of history through innumerable psychics, such as Madame Blavatsky and Edgar Cayce followed by authors like Bauval and Hancock who have in recent times attempted to place such legendary accounts on the throne of evidences supposedly based on modern science and technology.

Bauval's 'Orion Mystery' has popularized the ancient star religion of Egypt and its salient features decipherable from the Pyramid texts. James and Thorpe accepted Bauval's contention that the three Pyramids of Giza represented the belt of Orion but the final dating he has made of the three Pyramids of Giza vis-à-vis the claim of a geo-celestial lay

out originating in 10450 BC stands very much disputed. Hancock begins the narrative of the 'Fingerprints of the Gods' with a discussion on the mysterious maps of medieval and classic times accompanied by accounts of other incredible remnants of past civilizations such as those of Mexico [Maya, Aztecs and Olmecs] and Egypt. As Bauval saw in the ruins of Giza, Hancock suspects a celestial lay out for the sacred ruins of Teotihuacan and considers both as the legacy of a 'forgotten civilization of the past which had once as the *Popul Vuh* claimed "examined the four corners, the four points of the arch of the sky and the round face of the earth". In his subsequent work 'The Message of the Sphinx', described as 'a quest for the hidden legacy of the mankind' the Egyptian mysteries are further investigated in collaboration with Bauval to emphasize the chronology both have deciphered in the earlier works. The 'Heaven's Mirror' is a consolidated account in the same cast as the fingerprints of the gods, covering photographic accounts of the various enigmas such as the pyramids of Egypt, statues of Easter Island, ruins of pre-Columbian America, Angkor Wat etc.

In the words of Peter James [PJ] and Nick Thorpe [NT]:

"...most books on ancient mysteries are written by authors with little, if any, background in the fields involved - which range from ancient history and archaeology to geology and astronomy. Many of these titles, full of amazing claims about lost civilizations, Atlanteans, extraterrestrial visitors and the secret wisdom of the ancients are frankly very badly researched and can be completely misleading. The authors do not treat the evidence critically and deliberately over mystify subjects in order to convince readers that they are being told some awesome secret about the past".

"Although Hancock is a professional journalist, he presents a remarkably one-sided and often outdated view of the human past, which, in our opinion, denies the true builders the credit for building these impressive monuments".

PJ & NT have taken a middle path in critically examining the contents of the books enumerated above. There is no outright denial of the ancient mysteries or a tread towards biased conclusions and as expressed by them in the introduction, they have left the option for readers to have a conclusion of their own from the materials presented.

2. Ancient Mysteries and Astronomy

• What link can have the ancient mysteries with astronomy that it becomes a relevant topic in a work on the origins and theory of Zodiac?

The factors that inspired the present author to include this chapter came as an afterthought on the completion of the rest of the chapters. None of the above works, which happened to fall in my attention, directly addressed the Zodiac as an ancient mystery. Further I realized that as noted by PJ & NT, the 'drive behind the ancient desire' to create the mysteries such as the Great Pyramid also remains an unknown. Efforts to know more about these mysteries through Internet resources led me to the descriptions of the work 'Hamlet's Mill' - a work that remains totally unknown to Indian researchers in history of science. Hamlet's Mill is an investigation on the 'prehistoric' origins of scientific thought and its transamission through myths - metaphors in which ancient wisdom lies

encrypted - framed with the specific objective of conveying knowledge across generations. Even though I have not gone through the work, the central idea over which it has sprung up could be understood through the Internet articles and that central theme - the living wisdom of the myths - in fact has got its main repository in India, in the Vedas, Purāṇas and the Epics. Myths may not find a better compilation as in the ākhyānas and upākhyānas of our great epic Mahābhārata and taken together with the Vedic and Purāṇic myths we have got the greatest volume of ancient wisdom lying almost untouched in India. Despite the early works in India on the astronomical interpretation of mythology by scholars like Tilak and Sengupta the modern outlook towards the myths is one of skepticism - simply as an imaginative account of social origin devoid of any depth of meanings such as astronomical - and even in a field like history of science the astronomical content of mythology has not received its proper recognition.

When we interpret mythology as a technical language it is implicitly assumed that the ancient civilizations had a mental and social development far exceeding the 'preliterate conception' of modern cultural arrogance. Myths invariably are of multivalent interpretations and shall therefore remain cryptic till it reincarnates as a piece of living wisdom in our creative conscience and this peculiarity in fact proved to be a bane as well as blessing in the corridors of time that lead us to the prehistory. Myths could be transmitted down across the generations without the need of any scientific sophistication but the encrypted wisdom was lost with the break of the tradition even in a place such as India where the remnants of the ancient civilization are still very much a part of the social and religious life.

According to the reviews available on the Internet Hamlet's Mill is one of the common themes running through the world'd mythology - a Mill that turns on a spindle representing the earth turning under the heavenly canopy. This Mill of Time has its spindle or the axis of earth's rotation undergoing a slow wobble that alters its orientation with respect to the circle of fixed stars and the phenomenon known as precession of the equinoxes appear as allegories under many cultures of the world. Hamlet's Mill in fact is not the first work of its kind. The idea that precession of the equinoxes formed the substratum of many allegories in the mythological literature is very old and the original proponent of the idea as far as my knowledge goes is B.G.Tilak. As a phenomenon, the precession of the equinoxes can be understood only when the seasonal cycle is viewed against a sidereal frame of stars and the situation obviously suggests the possibility that some kind of a sidereal zodiac was in vogue in ancient times.

The idea of using precession of the equinoxes to date the ancient monuments on the basis of a supposed astronomical orientation came into vogue since the publication of *The Dawn of Astronomy* [1894] by Sir Norman Lockyer. Even though Tilak and Jacobi had placed the Vedic antiquity in a remote prehistory such as 4000 BC relying on the interpretation of Vedic hymns there were nothing a like a Stonehenge or ancient monuments like the Pyramids of Egypt and Meso America in India to apply the 'precession technique' to date them. Even among the ruins of Indus - Sarasvati civilization the situation is no different - an astronomically oriented temple structure is yet to make its appearance. Deciphering and eulogizing the astronomy underlying the Megalithic stone circles had its peak in the work of Alexander Thome [1967], who was a Professor of Engineering at Oxford University. Thom claimed to have proved the

existence of a network of megalithic observatories having precise and consistent alignments to solar and lunar phenomena based on advanced knowledge of geometry but in later years the work could receive tribute only as 'a product of the wishful thinking of a dedicated scientist'. In the words of Dr. Evan Hadingham [1983], archaeologist and science writer:

"*The result, in the case of Professor Thom's research, is a kind of science fiction in which the prehistoric Bretons operate their lunar observatory with a passion for precision suspiciously like that of modern engineers and astronomers. While the megaliths were indeed connected with beliefs about the sun and moon, it is clear that these were only aspects of a complicated mass of ideas and practices involving [religious beliefs].*

We must be grateful to Thom and his colleagues for awakening interest in the intellectual skills of prehistoric Europeans. Yet many of the claims for a Stone Age science are now proving to be little more than an unconscious projection of our contemporary technical world onto the silent ruins of four thousand years ago. There is little "hard" evidence to support the theory that accurate eclipse predictions were undertaken by the megalith builders, who would have found their task extraordinarily difficult in the absence of written recording aids".

It is against the above backdrop that we need to critically examine the revival of 'prehistoric super-science' apparent in the works cited earlier. To the list given at the outset we may add a few more exotic ones by Zecharia Sitchin viz., The Earth Chronicles: Book I - VI, all containing fiction presented as facts on the extraterrestrial authors of ancient civilizations.

3. Speculations on the wisdom underlying the Great Pyramid

I had the first occasion to know about the Great Pyramid and its mystery in 1994 when Dr. N. Gopalakrishna of Pune made available to me a copy of the work 'Cosmic Causation in Geophysics' [1945] by Paul Councel. Paul in his work has attempted an esoteric interpretation of the phenomenon of precession of the equinoxes, which he re-christened as the precession of Sun to derive the chronological system implicit in the periodicities of world evolution. The following words do contain the spirit of his esoteric theory:

"*What grounds support disbelief in solar government of human affairs? Is mankind any more than a superior species of the Earth's fauna? Is not every religion in human history a more or less disguised or prostituted form of solar worship, even Christianity? If you do not believe it, you are not versed in comparative religion and a bit of reading of Frazer's "The Golden Bough" is suggested. Is anything said of God in the Bible, or in any other secular sacred literature, that could not be said of the sun as the dispenser of life and death and the giver of every good and perfect gift?*

A panoramic answer to these questions will be found in the conditions of mankind along the lane described by the ecliptic and equatorial network lines of the map. From the virtual paradise given to man about five hundred years ago in the lush American

continents, on and on eastward to the depths of the South Pacific Ocean the evidence is clearly exhibited. Proven by eloquent ruins, great peoples once lived along this belt - mightier than fragmentary history even dimly records. What became of them? And what populated their lands with progressively decadent, degenerate and hopeless human lives? What happened to the mighty people whose ruins litter the islands dotting 6000 miles of South Pacific? Is it better to continue in child-like wonder about these things than to experiment with the idea that the Sun giveth and Sun taketh away?"

Paul's theory summed up as - "Civilization follows the equinox with continents, races and nations rising and falling in its path" obviously demanded conceptualization of a Geo-Zodiac over which the terrestrial sojourn of the cardinal points may be traced and he created it over the assumption that the Great Pyramid was built to mark the terrestrial station of the star Aldebaran of the Hyades cluster. Further for the precession based chronology he took '0' AD as the beginning of a new cycle with the equinox at sidereal zero point and entering the sign Pisces in its westward course. Paul Councel thus answered the question on the purpose for which the Great Pyramid was built by assigning to it role of a coordinator of cosmic causation in the terrestrial world.

Daniken too had described the GP with in a mystifying language but the works such as 'The Great Pyramid - Decoded' by Peter Lemesurier and 'The Pyramids of Egypt' by I.E.S. Edwards who was keeper of Egyptian antiquities in British Museum exploded much of the extraterrestrial mystery created by Daniken. It was after gaining this much exposure that I had the occasion to read 'Fingerprints of the Gods' and subsequent works of the same cast. In his best selling work Hancock arrives at the Great Pyramid at the 33rd chapter only after cruising across the rest of the mysterious world. Chapters 28 - 32 have matters related to precession - the topic of Hamlet's Mill - discussed in detail, of course without tracing the history of the astronomical interpretation of myths such as the Churning of the Milky Way. Chapter 31 is entitled Osiris numbers, as the author found the legend of Osiris as the earliest mythical record of the so-called precession numbers 12, 30, 36, 72, 108 and 360. It is true that these numbers do have a link with the phenomenon of precession but that's not the whole story. As I have already mentioned above, precession could not have been studied without the aid of a sidereal stellar zodiac or fixed frame of reference against which the slow wobble of the earth's axis and the seasonal phenomena could have been observed. All the above numbers in fact derive their significance out of the true sidereal zodiac viz., *Mūlādhāra Rāhu - Śikhi Cakra*, as:

→ **12** is the number of zodiacal signs
→ **30** is the number of degrees of a sign
→ **108** are the number of *navāmśas* (Units of $3^0 20'$) in the Zodiac. It's not just 72 + 72/2 as
explained by Hancock.
→ **360** is the number of degrees

• What is the significance of 72 - simply the period of 1^0 precession? If that is the case what extra significance can be there for 108?

None could have attached any importance for 1.5^0 precession and 108 years, leaving 2^0 and 144 years?

According to the author, in the Hebrew Cabala there are 72 angels through whom the divine powers may be approached and the Chinese secret/occult societies too employ the fractions and multiples of 72. The associated mystery is not just the number of years but the mathematical design of the Zodiac, the shrine in which all the occult powers are seated. As we have already discussed in the sections on Zodiac, the Hindu Zodiac is a mathematical abstraction of the ecliptic having **108** divisions or navamśas ($9 \times 3^0 20' = 30^0$) of $3^0 20'$ each and the fiducial star is located at 240^0 or the **72** *navamśas* mark the location of fiducial star considered clockwise from the zero and **36** considered anticlockwise. The seat of Kuṇḍalini [sum total of all the occult powers] Mūlādhāraṃ thus divides both the microcosm and macrocosm (Kālapuruṣa or the Cosmic Man of Time) in the ratio **72:36** and hence the significance of these numbers in the occult traditions all over the world. It is only an accident that the equinox takes nearly 72 years to cover one degree or 108 years for 1.5^0.

Can anyone claim that the number 360 is significant as the precession covers 5^0 in 360 years? Had the rationale been the number of years, the whole series 72, 144, 216, 288 and 360 should have been there instead of only 72 and 36.

Another interesting aspect is the significance of the number 18. 18 permeate the Hindu tradition with a sanctity and spread quite unheard of for any other number in any other tradition. This peculiarity arises out of the same reason as above - in terms of Nakṣatras, the Mūlādhāraṃ is precisely at 18 Nakṣatras [$18 \times 13^0 20' = 240^0$] that makes 240^0. Rather than the mathematical property of being a fraction of 72 it is the meaning of that fraction on the Zodiac that makes 18 significant in the Hindu tradition.

Explanation that Hancock gives for the Angkor Wat as a precessional metaphor too is incomplete. The 5 Nagas × 108 statues in fact is a symbolic construction based on the Zodiac of five-elements (bhūtas) and 108 navaṃśas (54 in either half) worshipped as Kālasarpa/ Rāhu-Śikhi Cakra or the serpent of time/ Wheel of the Nodes of Moon conceived as a serpent.

This is one example that amply demonstrates the fact that the authors of these best sellers could not really penetrate the true mystery implicit in the ancient myths and traditions. What they have given is a speculative account that may be true or may not be true and therefore utmost vigilance is called for in accepting their notions as facts.

Entering the Great Pyramid

A brief account of the astonishing facts about the Pyramid is attempted to serve as an introduction to the general Indian audience.

• The Old Kingdom Pyramid of Khufu (Cheops) at Giza built around the middle of the third millennium BC is oriented to the cardinal directions with extraordinary precision. The

western and eastern sides deviate from true north by an average of three arc minutes only.

• No two sides are exactly equal in length: N=230.25m, E= 230.38m, W=230.35m and S=230.44m averaging to 230.355 = 755.79ft but the difference between the longest and shortest was only 7.9 inches and the four corners are perfect right angles being: N-E [$90^0$3'2"], N-W [$89^0$59'58"], S-E [$89^0$56'27"] and S-W [$90^0$0'33"].

• When complete it rose to a height of 481.4 ft [147m], the top 31ft of which are now missing.

• The four sides incline at an angle of about $51^0$52' to the horizontal. Lemesurier gives the slope as $51^0$51'14.3".

• Angle of the N-S descending passage is $26^0$31'23" and the ascending passage is of slope $26^0$2'30" [According to Lemesurier the angle is $26^0$18'9.7" and the axis of the descending passage was exactly aligned with the Dragon star in 2141 BC at its lower culmination]

• Ratio of the height [481.3949 ft] to its base perimeter [3023.16ft] is 2π and the latitude of the Great Pyramid is $29^0$58'51".

• Covering 13.1 acres at the base, the structure consisted of 2.3 million blocks of limestone and granite along with 115000 casing stones each weighing ten tons according to Hancock.

• Southern shaft of the King's Chamber has a slope of 45^0 while that of the Queen's chamber had the slope of $38^0$28', which respectively pointed towards Orion [Al Nitak or ζ-Orionis] and Sirius at the epoch 2450 - 2500 BC. Northern shafts of inclinations $32^0$28' and 39^0 were aimed at α-Draconis and the constellation of Little Bear.

Hancock saw the fingerprints of gods in the precision that the Great Pyramid depicts while PJ & NT as well as I.E.S. Edwards have credited it to Egyptians of 2500 BC with the necessary if not sufficient explanation as to how they might have accomplished the task. Latest in the line of researches is a paper entitled "Ancient Egyptian Chronology and the astronomical orientation of Pyramids" appearing in *Nature* **408**, 320-324 of 16 November 2000. This study provides reconfirmation to Bauval's dating of the construction of the Great Pyramid as in 2450 BC.

According to Egyptologist Kate Spence, in 2467 BC the stars Kochab in the bowl of the Little Dipper [β-Ursae Minoris] and Mizar [-Ursae Majoris] in the middle of the handle of Big Dipper were located on opposite sides of the north celestial pole and a plumb line intersecting these stars at the upper culmination of either one would have marked the true North on the horizon. Orientation of the various Pyramids relative to true north lends credence to the theory as may be evident from the comments of Owen Gingerich:

"The great pyramid of Khufu is the most accurately aligned to north, deviating just slightly to the west. The pyramid of Menkaure, the second pharaoh after Khufu, errs by about 13

arc minutes in the other direction, whereas the three earlier pyramids of Snofru, Khufu's predecessor, are oriented more westward as they get older. Other pyramids, built between 2600 and 2300 BC, confirm this trend, and their orientations form a straight line when plotted against time.

How can this puzzle be explained? Because of the Earth's precession, the celestial north pole was exactly aligned between Kochab and Mizar only in the year 2467 BC, and the errors in the orientations of earlier and later pyramids faithfully track the slow drift of Kochab and Mizar with respect to true north. Because the error in the Kochar-Mizar alignment can readily be calculated for any date, the error in each pyramid's orientation corresponds to a specific year. Although each alignment is subject to individual measurement errors, the collection of several data points makes the method more robust. So it is not preposterous to believe that Spence can calculate dates for pyramid construction to within five years or so, considerably better than the 100-year error currently accepted for their chronologies".

Relying on the four shaft angles Bauval too had the conclusion that the Great Pyramid was built somewhere between 2475 BC and 2400 BC. Shaft angles versus stars data for the epoch of Spence shall be:

Shaft	Angle	Star	Altitude at transit		Name
			2467 BC	2400 BC	
King - south	45^0	ζ-Orionis	$45^0$04'30"	$45^0$24'06"	Al Nitak
King - north	$32^0$28'	α-Draconis	$31^0$56'36"	$32^0$19'25"	Thuban
Queen - south	$39^0$30'	α-Orionis	$39^0$10'31"	$39^0$22'59"	Sirius
Queen - north	39^0	β- Ursae Minoris	$39^0$30'11"	$39^0$16'10"	Kochab

It is apparent from the above data that the theory of astronomical orientation of the shafts and the Spence's theory are in mutual agreement even though the former is not precise as the latter.

Bauval further recognized that the three pyramids of Giza in relation to Nile has the same profile as the three belt stars of Orion relative to the Milky Way as they were in 10450 BC in terms of relative position and visual magnitude versus the size of the pyramids. PJ & NT did agree with the first part of Bauval's thesis - the attempt of Egyptians to model heaven on earth - but chose to describe the dating of the configuration as wishful, farfetched and extravagant thinking.

4. Epoch of 10450 BC - Zero of Time?

Orion's belt is made up of stars δ [Mintaka], ε [Al Nilam] and ζ-Orionis [Al Nitak], which lie on the south of ecliptic.

Stars	Names	Sidereal		Altitude of meridian transit	
		Longitude	Latitude	20.8.2467 BC	1.1.4713 BC
δ -Orionis	Mintaka	$57^0$46'35"	-$23^0$33'12"	$45^0$51'37"	$33^0$36'43"
ε -Orionis	Al Nilam	$58^0$52'40"	-$24^0$30'24"	$45^0$22'37"	$33^0$12'43"
ζ-Orionis	Al Nitak	$60^0$05'53"	-$25^0$17'36"	$45^0$04'30"	$32^0$59'55"
λ-Scorpii	Shaula	240^0	-$13^0$47'17"	$38^0$46'38"	$51^0$26'30"

Altitude of the meridian transit h is expressed as: sin h = cos $\phi \cdot \cos \delta + \sin \phi \cdot \sin\delta$. For $\phi = 29^0 59'$, it reduces to sin h = 0.866cosδ+0.4997sinδ. When $\delta = 90^0$, h = ϕ and as δ lowers h increase to a maximum value of $60^0 01'$ at $\delta = 0^0$ [for the case of equator]. Negative declination means the altitude is so much below equator i.e., $60^0 01'$+ (-) δ and thus the extremes of elevation from the horizon is achieved with the opposite extremes of δ. Considering the variation of δ in familiar terms of celestial longitude λ and latitude β:

$$\text{Sin } \delta = \text{Cos } \omega \cdot \text{Sin } \beta + \text{Sin } \omega \cdot \text{Cos } \beta \cdot \text{Sin } \lambda$$

Compared to λ, ω and β can be treated as constant and thus for the epoch 1.1.4713 BC the variation of δ for Al Nitak may be expressed as:

$$\text{Sin } \delta = 0.3672 \text{ Sin } \lambda - 0.40255.$$

This gives for $\lambda = 270^0$, δ_{max} as $-50^0 20'$ [h = 10^0] and when $\lambda = 90^0$, δ_{min} as -2^0 [h = 58^0]. In terms of the sidereal zodiac Al Nitak has a longitude of 60^0 and as such λ would have been 90^0 for ayanāmśa of (-) 30^0 at the beginning of the Age of Aquarius in 2400 AD when the star will have its maximum altitude. On similar lines the star would have been at the low altitude transit when λ was 270^0 i.e., when the Age of Leo had its beginning in 10600 BC.

Bauval has interpreted the low altitude transit of Al Nitak as marking the 'First Time' reverentially referred to in the sacred literature of Egypt. Hancock also has referred to Bauval's discovery in his work but both the authors are not clear as to what was the real significance of this 'First Time'. It is easy to speculate as the beginning of the Age of Leo - but under what conception of the Zodiac - is a difficult proposition to answer. In other words what made the low altitude transit of Al Nitak so remarkable as to be remembered for millenniums and inspired Egyptians to copy and model the Orion's belt of that date over the Giza plateau?

Answer to these questions lie in the true sidereal zodiac for which λ-Scorpii [Shaula] is fiducial with a fixed reference longitude of 240^0 that marks the macrocosmic and microcosmic phallus. Over the sidereal zodiac Al Nitak has a fixed celestial longitude of $60^0 05'$, which probably was approximated in ancient times as 60^0. At the epoch of 10600 BC, the cardinal points occupied the quarters of Mūla with the summer solstice falling exactly over it - very much like the situation of 4137 BC when autumnal equinox was over Mūla, which we considered in earlier sections as the original epoch of the Zodiac. Mathematically winter solstice coincided Al Nitak and in the Egyptian /Babylonian practice of taking Libra 0^0 as the initial point Al Nitak marked the microcosmic and macrocosmic phallus at 240^0 from the beginning of Libra. Bauval's identification of the Orion's belt as the phallus is arbitrary, just to suit the interpretation of abstract sacred verses of Egyptian antiquity. Osiris - Isis / Orion - Sirius copulation and the birth of Time God Horus is a myth for which parallels can be found in Hindu mythology in relation to similar gods of time.

Ruins of Central America

The symbolism associated with the ruins of Teotihuacan also arises out of the prehistoric

Zodiac viz., Mūlādhāra Rāhu-Śikhi Cakra. Rāhu & Śikhi, the head and tail of the famed serpent of Hindus, are the nodal points of intersection of the paths of sun and moon and bears the title of Kālasarpa or the serpent of Time. The cult of Quetzalcoatl also had the same emblem as is being attested by the different ruins of Mexico. The Teotihuacan pyramids are dedicated to the sun and moon and the serpent god born of sun and moon in symbolism with the zodiac of Nodes for which the fiducial or reference star is Mūla which is located at the center of the Milky Way and represents death. Experts have equated the Way of the Dead with the Milky Way and also as a terrestrial map of the zodiac/solar system - both of which are implicit in the Serpent Wheel of Time, Rā-Śi Cakra.

Ancient traditions of not only Egypt and Central America but also of India conceived the Milky Way as the path of the souls to the netherworld. In the Hindu zodiac, the fiducial star located at the galactic center forming the junction of Scorpio and Sagittarius has the deity Nirṛti, who is a synonym of death.

At Chichen Itza of Yucatan, the central pyramid is dedicated to Kukulkan - the Maya version of Quetzalcoatl meaning 'feathered serpent'. According to Hancock, at the top of it a sculpted puma with its mouth open represented the gate of underworld and it bore 72 spots formed by pieces of jade embedded into its body. The structure signaled the equinoxes by a magical epiphany of the 'feathered serpent' formed by patterns of light and shadow on the western side of the northern stairway cast by the setting sun. 72 depicted on the symbolic entrance to the netherworld clarifies without uncertainty that it marks the location of the fiducial star at the 'death point' which divides the wheel of time in the ratio 72:36 in units of $3^0 20'$. Other numbers involved too arise from the same fact, location of the fiducial star in different sexagesimal units:

Unit	Ratio	Divisions
30^0	8:4	12
$13^0.3333$	18:9	27
$3^0.333$	72:36	108
1.666	144:72	216
13'.333	1080:540	1620
3'.333	4320:2160	6480

Hancock in his work 'Heaven's Mirror' has also referred to the temples of Angkor Wat and John Grigsby's discovery in 1996 that the temples of Angkor replicate the constellation Draco. In 10500 BC, the constellation Draco was over the meridian at the moment of sunrise for the spring equinox and the temples precisely replicated on the ground the stars of Draco and the ecliptic north pole.

Dendera Zodiac

The circular zodiac of Dendera or the conclusions of Alexander Gurshtein may not evoke any wonder when we take note of the fact that the Zodiac was originally conceived as a mathematical abstraction at 4137 BC or 10500 BC when the autumnal equinox/ summer solstice was in conjunction with Mūla of fixed sidereal longitude 240^0 that marked the

boundary of Sagittarius and Scorpio. In the subsequent period cardinal points were transiting in Scorpio, Leo, Taurus and Aquarius - the constellations of prominence in Dendera Zodiac. Among all mysteries and sacred architecture, the Zodiac is the greatest and the precessional code is encrypted in it in the most ingenious way than in any other monument. The 'deliberate attempt to encode complex information in enduring monuments using a mathematical language' - is in fact the conception of sexagesimal notation in which the precessional code is implicit as a natural byproduct. Hancock had only little idea of the obsession of Hindus with time as is evident from the following observation:

"If the calendar, and the preoccupation with time, had been part of the legacy of an ancient and forgotten civilization the Maya must be ranked as the most faithful and inspired inheritors of that legacy. 'Time' as the archaeologist Eric Thompson put it in 1950, 'was the supreme mystery of Maya religion, a subject which pervaded Maya thought to an extent without parallel in the history of mankind".

Nothing can be more far from truth. The living tradition of India and its mythology are more obsessed with Time than in the case of the Maya tradition. Of course it is true that despite the literary records, India is devoid of any monuments such as the Pyramidal observatories of Maya and the precise astronomical observations. This may be because of the much greater antiquity of the Indian tradition than that of other ancient civilizations.

5. Great Pyramid - Zero Point of the Geo-Zodiac

Leaving aside the controversy of its genesis and date - the clumsy and controversial historical details or the incomprehensible mystery associated with its geometry and construction, we shall focus our attention onto a deeper significance - the creative aspect - what really was the purpose for which the great pyramid was built in prehistoric times?

When we reflect upon the aspect of its purpose, the first arrival in our minds will be the thesis of Paul Councel, which we have referred to at the outset. Paul Councel proposed that the great pyramid marked the terrestrial station of Aldebaran (Rōhiṇī), which was in conjunction with the vernal equinox of epoch 3240 BC. But Paul did not give any substantiating grounds for the resultant Geozodiac as the coordinator of mundane evolution. Nevertheless his work did inspire me to have further thinking on a precise definition of the Geozodiac and the present work took shape in consequence. Before going into the details I would like to express my sincere gratitude towards Dr. N. Gopal Krishna of Pune for providing me a copy of the work of Paul Councel in 1994 as well as for the constant encouragement given by him ever since.

World evolution- the temporal sequence of mundane events over the geographical regions - in unison with the cosmic phenomena has been one of the major planks of astrology and occultism since the days of inception of these disciplines. In the astrological de-lineation of the mundane events co-ordination of the Cosmos with the terrestrial longitudes is quite necessary, but unfortunately we never had a precise technique in the known history of astrology. The prevailing practice is to follow the empirical information or convention by which certain cities/regions have been affiliated to particular Rāśis or Nakṣatras. These observational results provided no explicit rationale that can be applied

to the Earth as a whole to decide over the ruling signs of different localities. Tropicalists define their "Geozodiac" by superposing the ecliptic over the terrestrial-equator on the Greenwich Meridian. This method is arbitrary in-view of the fact that the same geographical region will be successively ruled over by different arcs of the heavenly zodiac in due course of time and quite absurdly the vernal equinox will always be falling over Greenwich. If the method is followed, astrology will be deprived of the use of 'Precession of the Equinoxes' in understanding history - the rise and fall of civilizations as well as all related cosmic causations. To understand world evolution, what we need is a precisely defined fixed Geozodiac that will provide a permanent tie-up with the ecliptic i.e. the sidereal zodiac having a fixed initial point. A fixed Geozodiac obviously leads to permanent affiliation of geographical regions with the cosmic-belt above and hence the regression of the vernal equinox can be conveniently used for correlating mundane events occurring at intervals less than that of the precessional cycle.

Even though the idea of a Geozodiac as outlined above is very simple, nobody could so far offer a satisfactory definition.

Mystery of the Great Pyramid - Modeling the Zodiac on Earth

As we saw already many have described the great pyramid as a monumental proof for the pre-historic existence of a great civilization on our planet. But as regards the purpose there has been only speculative thinking like that of Paul Councel, in the West. In the East, especially in India, I have not come across any significant literature on the Pyramids or on the astrological analysis of mundane evolution. It is obvious that the Great Pyramid couldn't have been constructed during a limited number of years or even a few decade. Prolonged activity extending over such long periods by sacrificing innumerable lives in the course of work, in such pre-historic past, might have been for some purpose of cardinal importance. Otherwise it would have been impossible to sustain the enthusiasm of the people on an onerous task like the construction of a mammoth stone pyramid. The western minds are generally latched up in their thinking about the role of some of the fixed stars like Aldebaran (Rōhiṇi), Antares, (Jyeṣṭha), Spica (Citrā), Formalhaut (Śatatāraka) etc., but there is no agreeable definition of their fiducial role. It is therefore difficult to conceive a precise definition of the Geozodiac by presuming pyramid as the terrestrial location of either of these prominent stars. On the other hand I'm inclined to hypothesize that the great pyramid was raised to mark the location of the zero point of the sidereal zodiac. Rather than solving the mystery, the hypothesis only deepens it as we have no idea as to who would have taken so much pains to mark the cosmic zero on the globe and where from they might have received the know-how? Where from they came and where have they gone? We will be adding a few more unanswerable questions to the existing lot on the mystery of the pyramid.

To put the idea in brief: *The great pyramid marks the geographical location of the zero point of the Geozodiac.*

How can a thesis like this be substantiated? What kind of evidence is possible, when the available records speak nothing of such kind - only mystery is perceivable around and inside the great pyramid?

The evidence that is presented below is an occult interpretation of the mythological profile of Kṛṣṇa by Kṛṣṇadvaipāyana Vyāsa in his work Bhāgavata purāṇa:

Many of the purāṇic episodes can be interpreted as astronomical allegories and many of the characters can be therefore identified on the sky. Churning of Milky Way (Kṣīra-sāgara) is a typical example. The 'Mandara' mountain with the serpent Vāsuki as the rope, symbolize the precession of the equinoxes - mountain being the earth's axis and Vāsuki the celestial equator. Devas who held the head represent the Devayana or Uttarāyana half of the zodiac from vernal to the autumnal equinox while the Asuras holding the tail signify the latter half of Pitryāna. Śiva or Rudra of the story is Mūla nakṣatra occupying the junction of Scorpio & Sagittarius (240^0) where the Ākāśa Gaṅgā cuts the ecliptic. The referential epoch can be understood from the story line that Rudra drunk the 'Viṣa'* vomited by Vāsuki viz., Kālakūṭa meaning the 'puzzle of time'. Viṣa here-in signify either of the cardinal points that equally divides the year and as already we have seen in 4137 BC the autumnal equinox coincided with the Mūla star when the sidereal zodiac was created out of the equator-ecliptic or Geo-solar-Galactic geometry. Another remarkable story is that of Dakṣa's 27daughters including Rōhiṇī getting wedded to moon, suggesting obviously that the whole story including the Yāga (sacrifice) took place over the ecliptic. Other than Purāṇas the epic-stories like Rāmāyaṇa and Māhābhārata evolve out of the two original clans presided over by the Sun and Moon respectively. Another major character of the Purāṇas Viṣṇu being referred to as Nārāyaṇa i.e., precession personified - conch shell in his hand is of anti-clockwise spirals i.e. from left to right in the same direction as that of precession and the cakra or wheel is the Zodiac. Lotus signifies the seasonal year and Śeṣa the constellation Draco or perhaps the eternal Time.

As we have already come to realize in earlier sections, the crux of Hindu mythology is Time in its numerous personified forms. The greatest of such personification is the fiducial star of the zodiac placed at the galactic center, Mūla appearing as Mahākāla - the supreme god of the Tāntrics. Viṣṇu by mythological accounts is also a Time-God, apparently personification of Ādityas or Sun. On a deeper look it appears that Viṣṇu represents the ecliptic north pole around which the sun and north celestial pole (Dhruva) revolves. The legend of Dhruva - son of King Uttānapāda [Cepheus] - adds credence to this identification. According to the popular interpretations of the purāṇic chronology Viṣṇu is believed to have taken nine Avtars by 3102 BC when the Kaliyuga of 432000 solar years had its beginning. The last of these incarnations was Kṛṣṇa born in Rōhiṇī nakṣatra at Mathurā and had his exploits over the geographical region extending from Prāgjyotiṣapura on the East to Dvārakāpuri on the West. This mythological profile of Kṛṣṇa may be interpreted as an allegorical description of the terrestrial sojourn of vernal equinox over the Geozodiac with the pyramidal zero point.

Substantiation of the Pyramid-zero

- Longitude of the Great Pyramid with reference to Greenwich =31E15
- Longitude of modern Mathurā, the birth place of Kṛṣṇa = 77E40 [$46^0$25' east of GP]
- Longitude of Prāgjyotiṣapura = 91E45 [$60^0$30' east of GP]

• Longitude of Dvārakāpuri = 69E01 [$37^0$46' east of GP]

Longitudinal arc between Prāgjyotiṣapura and Dvārakāpuri = $22^0$44'
Number of years that the equinox will take to transit the interval = 1637

From the earlier sections on the Zodiac we know that the equinox transited over the 60^0 of the sidereal zodiac in 4137 BC. From the above data it is evident that from 4137 BC to 2500 BC, the vernal equinox was transiting over the longitudinal interval between Prāgjyotiṣapura and Dvārakāpuri during which the events of Bhāgavatapurāṇa probably unfolded.

It is a remarkable coincidence that the equinox was over Prāgjyotiṣapura [60^0 east of the pyramid zero coinciding with Al Nitak or Zeta Orionis and antipode to λ-Scorpii] in 4137 BC when the Zodiac was originally conceived or probably reconstructed after the original epoch around 10500 BC. 'Prāgjyotiṣapura' in fact literally means 'the eastern city of Jyotiṣa or astronomy'.

The Rōhiṇī midpoint $46^0$40' correspond to the terrestrial [referred to Greenwich] longitude of $77^0$55', which lies between the longitude of Agra [78E05] and modern Vrindavan [77E44]. It is possible that the Purāṇic Vrindavan on the side of Kāḷindi might have corresponded precisely to the longitude of 77E55. Kāḷindi represented the Ākāśagaṅgā on the earth. Tajmahal at Āgra and the city of New Delhi or Indraprastha [77E12- the star Rōhiṇī is at $76^0$26'] may have their origin when the vernal equinox transited over these longitudes. The discrepancy of a few minutes in the geographical longitudes can be ignored, as we are unaware of the original locations of their namesakes in the modern world. Vasudeva and Devaki, the mythological parents of Kṛṣṇa may be in fact the ecliptic and equator, personified originally as Kaśyapā and Aditi.

Gaṅgā - the Galaxy.

It is a well-known fact that the Milky Way or Ākāśa Gaṅgā cuts the ecliptic in the constellation of Taurus. The synonymous nomenclature of the galaxy and the Ganges must be noted. The reasons thereof are evident on computing the Geozodiac longitude of Gaṅgōtri. Gaṅgōtri is at47 E 50 of the Geozodiac in the earthly Taurus division in just the same way as the galaxy is placed on the cosmic belt. Haridvar where the Ganges enters the plains will be exactly 47^0 east of the great pyramid. From Gaṅgōtri it flows across a nakṣatra of longitude $13^0$20' to reach the sea at Chittagong [$60^0$35' east of GP].

Geographical Manifestation of Zodiac

Looking east. of the Pyramid we can find evidences of cosmic causation in the manifestation of mathematical zodiac over the geographical regions: Considering the longitude east of the great pyramid [denoted as Π]:

• Great Pyramid: Π =0

• Babylon: Π = 44E35-31E15 =13E20, i.e. Aśvini lies between Babylon and Cairo - two of

the biggest cities of the Middle East. Baghdad also falls on the same longitude.

• Multan: Π = 71E28 - 31E15 =40E13, Multan or Mūlastānaṃ, the city of Kaśyapā marked the beginning of Rōhiṇī division. In Gujarat Suredranagar marks the beginning of Rohini.

• Arrah- Aurangabad - Chapra: Π =53E20, the 54th degree of Π is marked by a number of towns in Bihar where Rōhiṇī ends and Mṛga begins.

• Lhasa the capital of Tibet known for its mystic past is at a longitude of 91E05 corresponding to Π = 59E50 i.e. roughly 60^0E that marks the beginning of Gemini. Lhasa, the roof of the world also marks the 60^0E longitude.

• Manila (Π=90E15), Shanghai (Π=90E13), Taipei (Π=89E45) line marks the boundary of Gemini/Cancer.

• Tokyo, Π = 108E18 marks the star Puṣya.

• Sydney of Australia, Π =151E12-31E14 =120^0 E, is the end of Cancer i.e. Leo begins.

• Geozodiacal location of Mūla nakṣatra

Mūla nakṣatra having sidereal longitude of 240^0will be at 120^0 west of the great pyramid or with reference to Greenwich the terrestrial longitude will be 88W45 i.e. on the longitude of Chicago that cuts the equator in the Pacific near about Central America.

• Ruling Sign of India.

India becomes politically independent while Taurus $07^0$01[$37^0$01] was rising on the east. On the Geozodiac the corresponding longitude relative to Greenwich - Zero will be 68E16, which falls over Hyderabad of Pakistan. Junagad is 70E27 (Π=39E12), Dvāraka (Π =37E43) and the town nearest to the Indian Border viz. Ber is at 68E38(GZL= 37E23). The sign of Taurus begins at the western borderline of Pakistan and Afghanistan and the extent is up to Gauhati in Assam. It is therefore evident that the ruling sign of the sub-continent is Taurus only. The tribal areas east of Kāmarup [Prāgjyotiṣapura] fall in Gemini under the glance of Ārdra.

Geozodiacal Latitudes.

For an astronomical study of world-evolution we also need a hypothesis that can throw light on the latitudinal course of mundane destiny i.e. from the equator onto the poles - North & South. As the zodiac has two hemispheres across the line of symmetry or 300^0 - 120^0, on the Geo-zodiac equator can be placed along the same so that:

Latitude	Π:E or W	Ruling sign
00^0N0' to 30^0N0'	E	Cancer
30^0N0' to 60^0N0'	E	Gemini
60^0N0' to 90^0N0'	E	Taurus
90^0N0' to 60^0N0'	W	Aries
60^0N0' to 30^0N0'	W	Pisces
30^0N0' to 00^0N0'	W	Aquarius
00^0S0' to 30^0S0'	W	Capricorn
30^0S0' to 60^0S0'	W	Sagittarius
60^0S0' to 90^0S0'	W	Scorpio
90^0S0' to 60^0S0'	E	Libra
60^0S0' to 30^0S0'	E	Virgo
30^0S0' to 00^0S0'	E	Leo

The continents that lie in the Southern Hemisphere are mainly Australia, South America and the lower half of Africa. We have only little information as regards the history of these places and hence the main focus of our study will be the civilizations of Northern Hemisphere.

Cosmic Causation and World Evolution

Vernal Equinox [E] And the Obliquity Point [Ω]

In the preceding part we have tried to reconstruct the Geozodiac as existed in the prehistoric times. The Geozodiac alone is not sufficient to trace the course of mundane destiny. We also have to identify the astronomical parameters that are significative of the evolutionary process. In the popular definitions of the Zodiacal Ages like Taurus, Aries, Pisces etc., one of the parameter is available viz., the vernal equinox as causative of a paradigm shift on the various aspects of our existence. It is of no practical utility if we ascribe to vernal equinox both the regenerative and degenerative powers in view of the confusion as to what will actually manifest. As regards a second parameter that can be conveniently used to trace the course of mundane destiny only speculations exist. Certain people have suggested the winter and summer solstices as destructive and constructive respectively in nature. A vital clue in this regard is available in the 'Brhatsamhitā' of Varāhamihira. Hindu Astro-meteorology as described by Varāhamihira makes use of the beginning of Ārdra i.e. $66^0$40'of the sidereal zodiac, in weather forecast while assuming a coincidence of the sidereal and tropical zodiacs at his epoch. Under such circumstances the only astronomical rationale that can be thought of for the technique is the definition of 'Ārdra' or 'Wet point' as "Summer Solstice – obliquity of the earth's axis". The principle can be conveniently applied to identify a second astronomical parameter to examine the course of mundane evolution i.e. we may define an "obliquity point" (OP) on the west of the vernal equinox just as 'Ārdra' is defined relative to the summer solstice. In the known history of last 2000 or 3000 years obliquity had very little variation and we may use the

approximate value of $23^0.5$ or 24^0 in our analysis of history. As the equinox takes 72 years to traverse one degree the obliquity point will fall over a particular location roughly 1680 years earlier to the fall of equinox.

When we look at Indian antiquity it is evident that the Indus – Sarasvati civilization had its last phase around 2500 BC and doom by 1900 BC, almost coinciding with the fall of vernal equinox over Dvāraka and the western coast of the subcontinent. So when we look for a civilizational beginning or the regenerative cosmic factor, the obliquity point is apparently a good choice if it provides a reasonably good explanation of the rise and fall of civilizations over an interval of 24^0 of precession or 1700 years.

Remote antiquity - the beginning at Prāgjyotiṣapura in 5865 BC

The cosmic light of civilization viz., Obliquity Point [denoted hereafter by Ω] defined as 'vernal equinox + Obliquity' passed over Prāgjyotiṣapura towards west in the year 5865 BC. Equinox had its course in 4137 BC towards west transiting Delhi and Mathurā around 3100 BC and entered sea at Dvārakāpuri in 2500 BC. The heavy death and destruction described in the Mahābhārata and the fall of Dvārakā finds here an explanation. As the Indian subcontinent had a geodetic width of 24^0, as the culminative equinox passed over Prāgjyotiṣapura in 4137 BC the regenerative obliquity point simultaneously had its exit at the west coast leaving the subcontinent for a gradual decay and took the civilization to the west through Iran, Mesopotamia etc. towards Egypt.

Rise and fall of Babylon (Π =$13^0$20')

The obliquity point touched Babylon in 2396 BC while the fall of equinox [denoted hereafter as E] corresponded to BC 715. Babylonian empire (Mesopotamia) had its glorious period in between these epochs. The equinoctial age of Aries had begun in BC1909 at Π = 30E0 i.e. 30 east of the Great Pyramid, in between Mesopotamia and Persia.

Pyramid in focus - Egypt & Greece

Ω coincided with the Pyramid in BC 1462 and the equinox in AD 233. Civilization or regeneration followed Ω towards the west of Pyramid since BC 1462 to reach Athens the capital of Greece near about B. C. 1165. Athens had its glorious period up to the fall of equinox in AD 685. Similarly Alexandria (Π =35E55) had its ascendancy up to AD 315. The epoch of Ptolemy is AD 150 while Alexander founded Alexandria near about 300 BC.

Advent of Jesus Christ

Geographical longitude of Bethlehem is 35E15 east of Greenwich i.e. 4^0 east of the Pyramid zero point and equinox transited over it in BC 48. Perhaps the so-called star of Bethlehem that guided the scholars from the East was the vernal equinox on its east-west course as per their computation. Rome had Ω = $341^0$15' or 18W45 i.e. west of the great pyramid, which the Ω had touched in BC 102. Rome was hence on its ascendancy and had its most popular hero Caesar at the helm in BC 48. Supremacy of the Jewish religion

probably ended with the fall of equinox on Jerusalem in BC 48. The gospel of Jesus Christ became more popular with the beginning of Piscean Age in AD 233.

Advent of Islam

Prophet Mohammed's birth is said to have taken place in AD 570. Irrespective of the Geo-zodiacal location of Arabia, this was a consequence of the Revati equinox i.e. vernal equinox fell over zeta Piscium in AD 576.

Equinox over Europe

Obliquity point entered Aquarius in the year A.D.704 and the 'Śatatāraka' in AD 1419. Equinox had its sojourn over U. Bhadra since AD 1192 and is presently located on the Geozodiac at 24W35 i.e. west of the Pyramid, at 06E40 relative to Greenwich within the borders of Germany. It must be noted here that the equinox falling over Europe did cause two world wars centered over Germany. Bonn, the capital of the former communist state is 07E06 east of Greenwich with $\Pi = 335^0 51'$ i.e. $24^0 09'$ west of the Pyramid and the vernal equinox was in conjunction with this point in near about 1967. It is obvious that the equinox had played a significant role in the political developments of the 20^{th} century Europe.

Equinoctial Age of Aquarius

The sidereal sign of Aquarius coincide over the Geozodiac with the British Islands. Ω passed over London in 522 AD, promising an age of prosperity for 1700 years. The equinox will grace past the regions of France in the coming three centuries and will fall over London in the year AD 2474 at $\Omega = 328^0 45'$ or 31^0W25' i.e. west of the Pyramid. Age of Aquarius will begin slightly earlier in AD 2385. It appears that the course of mundane destiny is not at all favorable to France and British Islands in the emerging centuries. Major cities like Waterloo (Belgium), Hague (Netherlands), Paris etc. are on the firing line.... Presently the equinox falls over the 7^{th} degree of geographical longitude east of Greenwich, which passes over Nigeria, Germany etc.

Mundane Evolution versus Latitudes.

We saw earlier that on the Geo-zodiac the equator falls along 120^0 and 300^0. As such Taurus 0^0 represent the North Pole i.e. 90^0 of Latitude. In this picture, the equinox coincided with 60^0 north latitude in AD 233 and by J2000 it has descended up to 35N25 while the obliquity point has reached up to the 12^{th} degree of north latitude. The space age that has blossomed in USA may be a contribution of the latitudinal course of equinox across Chicago (41N56), Newyork (40N45), Los Angeles (34N0) etc. It is interesting to note that the latitudinal equinox coincided with the latitude of Washington (38N50) in the year AD 1752, near about the time of American independence struggle. Within a span of hundred years it will move over Los Angeles and then to Atlanta, Georgia etc.

Transit of Solstices over the Geozodiac

In terms of the cardinal points, at any time two pairs of influences will be operating over

the terrestrial world. Like the vernal equinox and the associated Ω-point we may configure the summer solstice and its Ω-point [Ω_s] transiting over the Geozodiac. Ω_s passed over Prāgjyotiṣapura in AD 700 and now [J2000] the summer solstice is only 390 years east. Ω_s has just entered the 42nd degree of Taurus, i.e., the longitude of 73E15 – Baroda, Bikaneer, Islamabad etc.

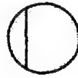
Considering the latitudinal course the summer solstice is moving over 54N35 with the Mercurial flavor of Gemini. Present century is of Betelgeuse [α-Orionis] over which the solstice will transit in the year 2090 AD. Longitudinally the signs of Sagittarius and Scorpio rule over USA, which are presently traversed by the slow, moving planets Uranus, Neptune and Pluto. This explains the lead role of USA in the field of High technology and the unipolar world emerging after the collapse of the USSR.

The analysis given above being an infant thesis, may not be answering all questions on mundane history satisfactorily. But the details given are I hope sufficient enough to inspire others for further studies in this direction. Just as we have identified the zodiacal locations with terrestrial stations, we may also affiliate the fixed stars appropriately with the various localities. Cosmic phenomena like the planetary aspects, conjunctions, transits, eclipses etc can be conveniently plotted over the Geozodiac for predicting the time and place of mundane events. For example: The zodiacal sign of Leo or the fixed star Regulus can be identified as the significator of Australia which lie in the Southern hemisphere and Vega or Abhijit can be tentatively assumed as signifying USA or North America for the purpose of research. To achieve scientific precision detailed studies are required on the different aspects. The fundamental idea can be appropriately fused with the western classical principles of mundane astrology by removing their tropical character.

Modeling heaven on earth

Much ado has been made of the Egyptian belief that considers Nile as the earthly equivalent of Milky Way. Such beliefs are only fragmentary as compared to the world of Hindu epics in which the phenomenal sky is condensed into geographical locations of India and some arbitrary locations such as poles where the Gods and demons reside. The most striking aspect is the terrestrial [Bhāgīrathi] and the celestial Ganges [Ākāśagaṅgā] – by the name itself a synchronism is achieved between the river and the galaxy. Further, the epics described the summer solstice by such names 'Amarāvati' of Indra, Mountain etc., winter solstice as the Himalayas, and equinox as Dvārakāpuri etc. In the Rāmāyaṇa and the Naḷōpākhyāna summer solstice is depicted as the terrestrial location of Ayōdhya [meaning 'of iron' ≡ Earth] and Mahābhārata allegorically describe the vernal equinox position as Dvārakāpuri. Equator also had the name Laṅka and Rāmāyaṇa described Laṅka as the seat of Nirṛta Rāvaṇa referring to the astronomical occurrence of the equinox over Mūla nakṣatra. Hindu epics and Purāṇas contain allegorical descriptions of the astronomical phenomena of the period from at least 4137 BC to 900 BC. It is evident from the motifs of Angkor Wat that the mythological Viṣṇu is personification of the Ecliptic North Pole located amidst the stars of Draco.

Astronomy underlying the Hindu epics Rāmāyaṇa and Mahābhārata when deciphered shall leave no confusion as to when and where the astronomical tradition had its beginning. Nothing comparable exists in any other part of the world.



"Science is a noble and enriching quest that helps us to make sense of the world in an objective and methodical manner. It does not deny a meaning behind existence. On the contrary, as I have stressed, the fact that science works, and works so well, points to something profoundly significant about the organization of the cosmos. Any attempt to understand the nature of reality and the place of human beings in the universe must proceed from a sound scientific base. Science is not, of course, the only scheme of thought to command our attention. Religion flourishes even in our so-called scientific age. But as Einstein once remarked, religion without science is lame."

Paul Davies

Appendix -II

Intricacy of Indian Chronology – A Reappraisal

1. Introduction

In the second chapter of this book we have already taken a glance at the confusion prevailing in respect of the dates of great historic figures such as Buddha, Candragupta Maurya, Aśōka, Ādi Śaṅkarācārya etc. A few authors have attempted in the past to add grandeur to their analysis of purāṇic/historical references by incorporating what they have called as 'astronomical proof'. All such claims of astronomical proofs have been found to be wrong by the present author and I have already referred to the controversy on Śaka era vis-à-vis the dates of Indian astronomers such as Varāhamihira, Āryabhaṭa etc. No one familiar with the Siddhāntic astronomical treatises shall place Varāhamihira, the author of Pañcasiddhāntikā in 123 BC or Āryabhaṭa -I at a date other than AD 500. Śaka era of BC 550 in all likelihood is a non-entity and reliance on an imaginary era shall be of no help in finding out the truth. To the extent the present author understands the cardinal aspects involved in redrawing the historic profile of our civilization are:

• Precisely datable history of India begins with Āryabhaṭa and his contemporaries.

• Prior to Āryabhaṭa we have a dark age till we reach back to the last days of Indus – Sarasvati civilization in 1900 BC.[1]

• Certain traditions, perhaps as blind as the articulated history taught in Indian Academies place Gautama Buddha around 500 BC while scholastic brilliance has ventured to call such traditions as rubbish and has placed Buddha in 1800 BC. Candragupta Maurya, Cāṇakya and Aśōka Maurya too have been taken back by 1200 years – to 1500 BC.

• Ādi Śaṅkara of 500 BC appearing in certain traditional accounts adds another dimension to the controversy.

Against the above background it is interesting to note that:

• Epics Rāmāyaṇa and Mahābhārata are astronomical allegories and as such the use of Bhārata War presumed to have taken place at Kaliyugādi of 3102 BC, as the sheet

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[1] It is true that we have no historical details about the nature of the Indus – Sarasvati civilization. But we know because of archaeological findings that a civilization certainly existed prior to 1900 BC. We can credit the period to prehistory and forget about it. On the contrary in the 2000 years that precede Āryabhaṭa, we have historical figures such as Buddha, Candragupta, Aśōka etc about whom we have created a history on fragile grounds that has been haunting the minds of all genuine seekers of truth. None are convinced about the chronology under academic use and the period is totally shrouded in darkness except for the knowledge that Alexander had visited Punjab in 320 BC.

anchor is not correct. Many of the epic and purāṇic accounts are about celestial happenings and have no historical or genealogical connections as is made out to be by historians. The historical connection between Kaliyugādi of 3102 BC and the legendary Mahābhārata War that Āryabhaṭa's work alludes to may not be correct. On the authority of Varāhamihira who was Āryabhaṭa's contemporary Sengupta did reject the Yugādi of Āryabhaṭa as an astronomical fiction of no historical significance.

• Pre – war genealogy as available in the purāṇas is astro-mythological and any cognizance to them as historical personages shall prove to be disastrous in reconciling the conflicts raging in the context of Indian chronology. A remarkable example for such an astro-mythical personage is Bhīṣma – the grandsire of Kurus. In the words of Sengupta:

"Last of all, it may be urged that Bhīṣma as a hero in the great fight is an impossibility – that his lying on the bed of arrows for 58 nights before expiry in anticipation of the day following the winter solstice is a solar myth. The orthodox Indian view is ranged against this allegation. If we agree that this was a myth, we should not lose sight of the fact that the real necessity for creating it lay in correctly finding the beginning of the **year One** of the Yudhiṣṭira era, of which zero year was the year of great battle. Hence even accepting the character of Bhīṣma in the fight as a solar myth, date of the Bhārata battle as found remains valid".

• If suppose such a war has really taken place in history and the astronomical allegory of the epic has superimposed over it the account of the true historical war, the historical war might have taken place around 1900 BC, coinciding with the desiccation of Sarasvati and its civilization. Post – war purāṇic genealogy therefore has to be reckoned from 1900 BC rather than 3102 BC that brings in an irreconcilable gap of 1200 years – the source of all controversies. This reconciliation even though arbitrary has the advantage that we need not resort to the series of falsifications such as Cyrus era of 550 BC, pre-dating of Āryabhaṭa, Varāhamihira and other siddhāntic astronomers. Also Buddha need not be pushed into the deep antiquity of 1887 BC.

• Scholars have dated the extant version of the epics and purāṇas after the date of Maurya dynasty during which time the Vedāṅga Jyotiṣa was under use. Epoch of Vedāṅga Jyotiṣa is obviously around 1450 BC. With Maurya dynasty dated to 300 BC or Buddha dated to 550 BC, scholars tend to place the final redaction of Rāmāyaṇa and Mahābhārata roughly between 3rd century BC to 500 AD.

• Vedāṅga Jyotiṣa is generally looked upon as the climax of pre-Siddhāntic Indian astronomy. This is not correct as may be understood from the present work, which indicate that the astronomical data implicit in the allegorical description of the Puṣya epoch of the epics belongs to 964 BC. Apart from the introductory description of the Puṣya epoch epic Mahābhārata consists of allegorical descriptions of older epochs such as 4000 BC. It is therefore evident that the Jyotiṣa that has survived time to reach us is only partial.

• Epics that took shape in the period since 964 BC has little influence of Gautama Buddha over them and hence in all probability Gautama Buddha had his birth after the uṣya epoch that finds an allegorical description in both Rāmāyaṇa and Mahābhārata.

Against the above background an attempt is made below to establish the epoch of Buddha following the approach of Prof. Sengupta.

2. Date of Gautama Buddha

Sengupta[2] had dated the references to a lunar and solar eclipse available in the Buddhist work Saṃyukta Nikāya to have occurred respectively on 29th December 560 BC and 14th January 559 BC respectively at Sṛāvasty [26 N 15, 81E 15]. According to the Pali text both the eclipses have taken place during Buddha's stay at Śrāvasty and Sengupta has assumed the stay to be of short duration to search for a lunar and solar eclipse occurring in succession across a fortnight. This dating of the eclipse suggests BC 544 as the year of Nirvāṇa [Ceylonese tradition] and BC 623 as the year of his birth [It is beyond controversy that he lived for eighty years]. BV Raman[3] has quoted Cyrus D.F. Abayakoon of Ceylon to take the birth details as Kaliyuga 2478, full moon of Vaiśākha coinciding with Tuesday. Relevant astronomical details are:

• Lunar eclipse: Full moon, Thursday 29th December 560 BC, 16:50 UT: JD [TDT] = 1517246.4134.
Maximum of the partial eclipse was 22:41 LMT with a duration of 2^h38^m for the umbral phase.

• Solar eclipse: New moon, Saturday January 14, 559 BC, 05:53 UT: JD [TDT]=1517261.9572. Eclipse began at 09:43 and ended at 13:15 with the maximum at 11:28 LMT.

Lunar eclipse had sun in Śrāvaṇā nakṣatra and moon in Puṣya, which according to Karandikar is the mythological Kaśyapa. Month was solar Makara or Pauṣa. Solar eclipse took place on the last day of the month. Winter solstice was on December 26 22:05 UT, 560 BC and hence it is likely that the full moon on Pauṣa might have been an year beginning as per the pūrṇimānta reckoning coinciding with the lunar Māgha and onset of Uttarāyana. Planetary positions for the said dates are given below for reference so that if any other details such as the identity of gods mentioned are decipherable from Pali texts, its astronomical basis can be examined.

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[2] Chapter XXI, page 217 –221, Ancient Indian Chronology
[3] Notable Horoscopes, P.10

Planetary Positions				
	Lunar Eclipse		Solar Eclipse	
Planets	Tropical λ	Sidereal λ	Tropical λ	Sidereal λ
Sun	272°50'	283°47'	288°35'	299°32'
Moon	92°50'	103°47'	288°35'	299°32'
Mars	302°05'	313°02'	314°06'	325°03'
Mercury	276°57'	287°54'	304°19'	315°16'
Jupiter	135°42'	146°39'	134°20'	145°17'
Venus	229°23'	240°20'	247°40'	258°37'
Saturn	76°55'	87°52'	75°49'	86°46'

- **Date of Birth of Gautama**

Full Moon: JD [TDT] 1493977.0221: 15th April 623 BC 07:08 [UT]: Wednesday. Birth being stated to be on Tuesday, the date will be 14th April. Planetary positions are:

Planets	14th April 623 BC Tuesday:07:07 UT 12:37 IST		15th April 623 BC Wednesday:07:07 UT. Full Moon	
	Tropical λ	Sidereal λ	Tropical λ	Sidereal λ
Sun	16°42'	28°32'	17°39'	29°29'
Moon	185°11'	197°01'	197°39'	209°29'
Mars	13°42'	25°32'	14°25'	26°15'
Mercury	38°39'	51°27'	39°37'	51°27'
Jupiter	357°28'	09°18'	357°41'	09°31'
Venus	351°16'	03°06'	352°28'	04°18'
Saturn	11°54'	23°44'	12°02'	23°52'
Śikhi	251°24'	263°14'	251°24'	263°14'
Rāhu	71°24'	83°14'	71°24'	83°14'

Source quoted above gives the birth time as around midday and the Lagna as Cancer.

- **Gautama Buddha in 1887BC?**

There have been many proponents for Kali 1215 or 1887 BC as the epoch of Buddha. Information that he was born on Vaiśākha Śukḷapaurṇami alone is not sufficient to fix the

date with authenticity. Full moon happened on Thursday 10th March 1887 BC, 2008 UT: JD [TDT] = 1032265.9112 but certain authors have claimed the birth to be on Tuesday. Viṣu was in the 31st degree of Mūlādhāra Cakra [Ayanāmśa30°15'] – preparing to leave Vṛṣabha (Taurus) and enter Meṣa (Aries). Legend that Buddha saved the goats/rams that represents Aries from sacrifice perhaps has an allegorical dimension.

3. Date of Ādi Śaṅkarācārya

• Gururatnamālika gives Śaṅkara's date as:

Tiṣye prayātyanalaśevatibāṇanetre𝑓bde nandanedinamaṇāvudagdhvabhāji I
Rādhe𝑓diteruduvinirgatamastralagne𝑓syāhūtavan śivaguruḥ sa ca śaṅkareti II

According to this verse Śaṅkara was born in Dhanur lagna and Puṇarvasu nakṣatra, in the month of Vaiśākha during Uttarāyana when 2593 years of Kaliyuga had elapsed, which corresponds to BC 508. Scholars have deciphered other details such as śukḷapañcami and sunday also from this verse and have considered this as very authentic information quoted by Ātmabōdha, 58th Ācārya of Kāmakōṭi Pīṭha in his commentary Suṣamā on the Gururatnamālika.

Jinavijaya, a Jaina work likewise gives the date of Kumārila Bhatta as the year 2077 of the Yudhiṣṭira era that corresponds to 557 BC. Same work gives Śaṅkara's demise in the year 2157 Yudhiṣṭira era or 477 BC.

Bṛhat Śaṅkaravijaya of Citsukācārya gives the detailed horoscope itself for the date falling in 2631 of Yudhiṣṭira era [508 BC] and accordingly the lagna is Kaṭaka and the planets Sun, Venus, Jupiter, Mars and Saturn were in exaltation signs. Authors A. Nataraja Iyer and S. Lakshminarasimha Śāstri who produced the work *The Traditional Age of Śrī Śaṅkarācārya and the Maṭhs* have stated the given planetary positions as true for the year 509 BC.

Citsukācārya is described as the lifelong companion and disciple of Sankara and as such we have no reason to doubt the information he has recorded.

• Veracity of the horoscope given Citsukācārya's work

Whether the information credited to Citsukācārya is original or an interpolation of the later years is a million $ question. Whatever may be the case, the planetary positions given in the 32nd Prakaraṇa of Bṛhat Śaṅkaravijaya do not belong to either 509 or 508 BC or in the neighborhood:

Planets	λ: BC 508 New moon of 19th March 17:11 Caitrādi	22.04.508 BC 12:00 UT Vaiśākha śukḷa pañcami Sunday	λ: BC509 New moon of 30th March 03:35 Caitrādi	03.05.509 BC 12:00 UT Vaiśākha śukḷa Pañcami Wednesday
Sun	352°53'	25°41'	03°14'	36°25'
Moon	352°53'	83°34'	03°14'	93°48'
Mars	28°31'	50°50'	238°20'	240°33'
Mercury	334°08'	06°50'	356°50'	14°40'
Jupiter	247°22'	246°49'	213°34'	209°30'
Venus	313°18'	353°23'	19°25'	61°31'
Saturn	335°54'	339°47'	325°28'	328°39'

These tropical planetary longitudes clearly indicate that the horoscope data referred above is a spurious one. Ayanāṃśa for the Mūlādhāra Cakra will be $10^{0}.25$ and neither of the planets will be exalted on the above dates. But T.S. Nārāyaṇa Śāstry had claimed in his work 'The Age of Śaṅkara' that the planetary data is correct according to astronomical computations: "*We have ascertained from two of the greatest astrologers of South India that this particular combination of the planetary bodies did actually occur on Vaiśākha (Meṣa) Śukḷapañcami of the year Nandana in 2593 of the Kaliyuga, corresponding to 509 BC*'.

• **'The Age of Śaṅkara' by T.S. Nārāyaṇa Śāstry**

Controversy on Ādi Śaṅkara's date received much popularity among the gullible public with the publication of a Sanskrit work entitled by 'Vimarśa' by Rājarājeśvara Śaṅkarācārya Svāmi of the Dvāraka Mutt in 1898 and 'The Age of Śaṅkara' by T.S. Nārāyaṇa Śāstry in 1916. In a detailed review of the latter work, T.S. Kuppaṇṇa Śāstry has described both the works as fiction and evidences and authorities quoted as fabrication: To cite a few notable observations:

→ "Another mistake of the concoctors that exposes them is giving Nandana as the year of birth in both the Śaṅkara-vijayas, while actually it must be Dhātā for 509 BC according to the astronomical Saṃhitās and Siddhāntas. They have got it by counting backwards one year of the Jovian cycle for each solar year and arriving at Nandana for 2593 Kali, on the mistaken practice now current in south of India...."

→ Narāyaṇa Śāstry's reference 'Jinavijaya' could not be located by TSK Śāstry in Jinaratnakośa, a bibliography of known Jain works or in Aufrecht's Catalogus Catalogorum and in the one he could locate the information quoted by Nārāyaṇa Śāstry is untraceable. The situation inspired an erudite scholar like TSK Śāstry to comment in bitter terms: "The author must have invented the name and concocted the quotations as there-from, thinking that evidence from a rival faith's work would be more convincing..."

→ TSK Śāstry has discussed in detail the issue of a copperplate inscription that the Śaṅkarācārya of Dvārakāpīṭhaṃ had quoted in his work as authority for the date. Net conclusion of his analysis is that the copperplate inscription and the works such as Bṛhat Śaṅkaravijaya, Prācīna Śaṅkaravijaya, Jinavijaya etc are all fabrications of recent times and are not genuine historical records.

• **True historical pointers to the issue**

→ According to the report of the Chinese traveler I-T'sing who was in India between 673 and 695 AD, Bhartṛhari died in 651 – 652 AD. I-T'sing makes no mention of Śaṅkara.

→ Kalhaṇa's Rājataraṅgiṇi places Bhavabhūti who was a disciple of Kumārila Bhaṭṭa in the year 733 AD as a contemporary of Kashmiri king Lalitāditya.

These two records place Śaṅkara's birth in 8^{th} century AD, provided there was only one personality by the name Kumārila Bhaṭṭa, whom Śaṅkara is said to have visited.

→ A number of floating verses place Śankara's advent during 788 – 820 AD, with birth in the year "Vibhava", which according to TSK Śāstry is an erroneous back computation made for Kali 3889.

→ Horoscope having Sun, Mars, Jupiter and Saturn exalted in Kendras, as recorded in Mādhavīya Śaṅkaravijaya[4] places the birth in 805 AD as found out by Pichu Aiyer, Cochin State Astrologer.

→ According to the legends prevailing in Kerala, the beginning of the Kollam era is associated with Śaṅkara's meeting with the king Rājaśekhara in 825 AD.

• Planetary positions that match with the legendary horoscope

Date: Tuesday, 8^{th} April, 805 AD, 1200 LMT, at 10N00, 77E00
[Ayanāṃśa for Mūlādhāra Cakra = $07^{0}57'$]

Planets	Tropical λ	Sidereal λ	Rāsi
Sun	$22^{0}01'$	$14^{0}05'$	Meṣa
Moon	$86^{0}54'$	$78^{0}58'$	Mithuna
Mars	$305^{0}28'$	$297^{0}32'$	Makara
Mercury	$38^{0}57'$	$31^{0}01'$	Vṛṣabha
Jupiter	$113^{0}29'$	$105^{0}33'$	Kaṭaka
Venus	$63^{0}30'$	$55^{0}34'$	Vṛṣabha
Saturn	$197^{0}07'$	$189^{0}11'$	Tulā
Rāhu	$192^{0}51'$	$184^{0}55'$	Tulā
Ketu	$12^{0}51'$	$04^{0}55'$	Meṣa

	Sun Śikhi	Merc. Ven.	Moon
	Rāśi		Lag. Jup.
Mars			
		Sat. Rāhu	

[4] Mādhavīya, II.71, quoted by TSK Śāstry: Collected Papers, p.368

Tithi is Ṣaṣṭhi on 8th noon but it will be Pañcami on 7th at noon (Moon = $64^0 24'$). On 7th evening Ārdra or α - Orionis rose at 1941 while Moonrise was at 1951 – so it was possible by observation to ascertain that Ārdra nakṣatra prevailed for the next 24 hours. If we strictly adhere to the tithi as Pañcami, the nakṣatra has to be Mṛgaśiras on 7th. Going by the Kerala tradition the nakṣatra is given more importance and hence the birth date can be taken as 8th April. This date agrees not only with the legendary horoscope but also with historical details. Further, it becomes apparent that this date formed the basic reference for those who have concocted history and horoscopes in the name of Śaṅkara for 509 BC. The manipulative process was as follows:

Sidereal period of Mars, Jupiter and Saturn were respectively 1.88081, 11.861775 and 29.45665 years and their product rounds up to 657 years. 805 AD – [2× 657] = - 509 or Kali 3907 – 1314 = Kali 2593 accompanied by a little more of jugglery to provide other details formed the basis of Nārāyaṇa Śāstri's theory.

This concoction did not succeed as the true positions of Sun, Mars, Jupiter and Saturn failed to recur at intervals of the mean period of 657 years and hence scholars like TSK Śāstry could expose the truth by computing the planetary positions of 509 BC.

- **Svāmi Sakhyānanda on Śaṅkarācārya**

In his work 'Ārṣbhāratapārambaryaṃ' Śri Sakhyānanda Svāmi introduces three Śankaracāryas whose profiles have become merged in the legends about Ādi Śaṅkarācārya:

→ Ādi Śaṅkarācārya of 508 BC, which we have found as a concoction by some people
→ Śaṅkarendra or Abhinava Śaṅkara, 37th Ācārya of Kāmakōti Pīṭha, Kali 3889 or AD 788, Vaiśākha Śukḷadaśami, born at Cidaṃbaram
→ Kāladi Śaṅkarācārya born in 805 AD, in Śatatāraka (Catayaṃ) nakṣatram about whom an inscription can be found in Tirunelveli district

Date: 30th March 805 AD: 1200 LMT at 10N00, 77E00
[JD(TDT) = 2015172.81544]

Planets	Tropical λ	Sidereal λ
Sun	$13^0 16'$	$05^0 19'$
Moon	$318^0 46'$	$310^0 49'$
Mars	$299^0 06'$	$291^0 09'$
Mercury	$21^0 29'$	$13^0 32'$
Jupiter	$112^0 57'$	$105^0 00'$
Venus	$57^0 15'$	$49^0 18'$
Saturn	$197^0 48'$	$189^0 51'$
Rāhu	$192^0 51'$	$184^0 54'$
Śikhi	$12^0 51'$	$04^0 54'$
Ayanāmśa used: $07^0 57'$		

Horoscope for Midday

	Sun Ket Mer	Ven				Lag Sun Ket				Sun Mar Rā	
Moo	Rāśi		Lag. Jup.		Navāmśa		Mar	Jup	Daśāmśa		
Mar.				Moo			Moo				Mer Ven
		Sat Rāh		Sat	Jup Rāh		Ven		Lag Moo		

Tithi is Kṛṣṇpakṣa ekādaśi and nakṣatra is Catayaṃ or Śatatāraka. This horoscope amply reflects Śaṅkara's genius as well as his life as a scholar and Parivrājaka. Rāhu's period at birth was 12 years 04 months and 23 days. As the horoscope is Madhyāyu he had his exit in 860 AD at the age of 55 in the major period of Mercury and sub-period of ill-placed Moon. Lagna is on Puṣya at $94^0 18'$.

→ **Evidence of the Chronogram: "Ācāryavāgabhedya" = 1434160** (Kalidinaṃ)

"Ācāryavāgabhedya" is the chronogram that marks the beginning of Kollam Era and the meeting of King Rājaśekhara with Śaṅkara in AD 825. For the sunrise on Friday, 25th August 825 AD, 0550 LMT [10N00, 77E00], the planetary positions are: [JD (TDT) = 2022625.55692245]

Planets	Tropical λ	Siddhāntic λ
Sun	$155^0 18'$	$150^0 15'$
Moon	$252^0 42'$	$247^0 39'$
Mars	$183^0 33'$	$178^0 30'$
Mercury	$177^0 50'$	$172^0 47'$
Jupiter	$30^0 43'$	$25^0 40'$
Venus	$182^0 23'$	$177^0 20'$
Saturn	$88^0 34'$	$83^0 31'$
Rāhu	$158^0 17'$	$153^0 14'$
Śikhi	$338^0 17'$	$333^0 14'$
Siddhāntic Ayanāmśa used: $05^0 03'$		

It is apparent from the above data that Kollam Era had its beginning with the solar ingress into Kanyā rāśi on Mūla nakṣatra. [True ayanāmśa = $08^0 13'$ is not used here as the Kollam era had its beginning as per Siddhāntic astronomy].

What is most surprising is that none of the Saṅkaravijayas give Kali 3906 [805 AD] as the year of birth of any of the Śaṅkarācāryas. On the other hand Kali 3889 or AD 788 that is generally accepted as the year of birth of Śaṅkara (whom some scholars have chosen to

describe as Abhinava Śaṅkara) does not tally with the legendary horoscope in any manner. Reference to Śaṅkara as "Kālaṭī Śaṅkarācārya born on Śatatāraka" in the Tirunelveli inscription, rules out the possibility that he was born in Vaiśākha Śukḷadaśami of 788 AD.

4. Date of Kāḷidāsa

Date of Kāḷidāsa is equally controversial as that of Śaṅkara and Buddha and the dates suggested varies from 3rd century BC to 6th century AD. A namesake astrologer of 1243 AD (as given by Sengupta) adds further complication. It is quite unlikely that any Kāḷidāsa of 13th century AD shall write a book on Jyotiṣa for crediting it to a historical personality of his name who lived more than a millennium ago. What might have really happened is interpolation of the original Jyotirvidābharaṇa (of the original Kāḷidāsa) by some mischievous astrologer of the 13th century in such a way as to antedate its antiquity to the legendary times of Vikramāditya – as reflected in the Vikramasaṃvat of Kali 3045 or 57 BC. Sengupta has given a detailed account of the astronomical references available in the works of Kāḷidāsa, which amply illustrate his familiarity with the cannons of Siddhāntic astronomy and also his interest in astronomical observations. For the same reason it stands established that Jyotirvidābharaṇa and Uttarakālāmṛta are the astrological works produced by Kāḷidāsa. Important arguments used by Sengupta for fixing the date to be the middle of 6th century AD are:

- Yakṣa addressing the cloud on the last day of Āṣāḍhā

In Meghadūta Yakṣa has spoken of his exile expiring after four months on Kārttika Śukḷa(11) on the last day of Āṣāḍhā which in turn means that the beginning of Cāturmāsya or summer solstice coincided with 11th day of the bright half and the last day of Āṣāḍhā simultaneously. This is possible only in a solar reckoning and accordingly Sengupta fixed the date under reference as 20th June 541 AD. Relevant modern astronomical data is:

Summer solstice: Thursday 20th June 541 AD, 10:53 UT: JD [TDT]: 1918829.00341
Sun: 90^{0}, Moon: 226^{0}47' ; Tithi is Śukḷa (12). As Siddhāntic ayanāmśa was zero at this time, Śukḷa (11) on Wednesday would have been the last day of the solar month of Āṣāḍhā.

- Astronomical simile describing the reunion of Duṣyanta and Śakuntaḷa: Lunar eclipse over Rohiṇi (α - Tauri)

Full Moon: 8th November 542 AD, 1707 UT: JD [TDT]: 1919335.26264. Moon: 48^{0}26'
At Ujjain [23^{0}N09', 75^{0}E43'], eclipse lasted between 1909 and 0125 on 9th November as Moon ascended the sky from an altitude of 26^{0} to 67^{0}. Totality was between 2125 and 2309 and at the end of the eclipse Moon's longitude was 50^{0}05' – only half-a-degree east of Rohiṇi in celestial longitude and one degree above in altitude.

No similar total eclipse could be located during the first century before Christ, which the extant Jyotirvidābharaṇa suggests as the time of Kaḷidāsa.

• Agastyacinha or summer solstice

Many scholars have interpreted the reference to Agastyacinha as a pointer towards the date of Kāḷidāsa. This is far from truth because of the following reason:

Agastyacihnādayanāt samīpaṃ diguttarā bhāsvati sannivṛtte
Ānandaśītāmivavāspavṛṣṭiṃ himaśṛutiṃ haimavatīṃ sasarja
[Raghuvaṃśa: XVI.44]

Sengupta has interpreted the verse as: "When the sun neared the summer solstice which was the place of Canopus, North caused a flow of ice from the Himālayas, which was like a delightfully cold shower of rain".

The verse actually means: "As the sun transited the North around the solsticial mark of Agastya (Canopus), Himālayas caused ice to fall like a delightful shower".

Reference to 'North' needs an explanation here. Uttarāyana begins at the winter solstice and ends at the summer solstice where Sun attains maximum northern declination. By the true astronomical perspective Uttarāyana begins at the extreme south point and ends at extreme north point and hence Kāḷidāsa used the terms 'diguttarā bhāsvati sannivṛtte' which may mean: "as the sun transited the North" near the solsticial mark of Agastya on the ecliptic. Further, it is to be noted here that the verse does not refer to any astronomical observation – it's a theoretical conclusion that Agastya had a polar longitude of 90^0 and was hence at the end of Mithuna rāśi. Kāḷidāsa could not have observed that the sun is near Canopus at the time of summer solstice as Canopus is not visible [rising and setting during day hours] when sun transits Gemini and Cancer. This is further evident from the fact that the solsticial colure passed through Agastya only in the year 916 AD. Astronomically, Agastyacihna therefore is the summer solstice of AD 916 – i.e., more than 5^0 [precisely $5^0 11'$] west of its position in AD 542. What date indication can then be obtained from the above verse?

• Sengupta did wrongly interpret another verse too: Raghuvaṃśa XI.36: The simile used herein equates Rāma and Lakṣmaṇa with the stars Castor and Pollux which Prof. Sengupta interpreted as due to the fall of solsticial colure on Castor. In his words:

"*To the poet why the stars Castor and Pollux were so charming was that the sun reached the summer solstice at a place near to them and the bursting of the monsoons took place. In the annual course, the star Castor's place is first reached by the sun. We shall not, therefore, be very wrong to assume that the poet indicates that the summer solstice of his time lay very near to the place of this star...*"

The verse means nothing like that as both the stars cannot be visible 'as charming or otherwise' around the time of solstice 'during the bursting of monsoons'. Undoubtedly the verse is not inspired by any observation of the stars Castor and Pollux near about the solstice of AD 546 or by the astronomical knowledge that the solsticial colure had passed through Castor in his time. It is only inspired by those stars, popular as celestial twins all over the world and has no connection with epochal solstice was passing through Castor

or not. Solsticial colure could not have imparted any extra charm to the stars as Sengupta has tried to make out.

Irrespective of the above discussed reference to Agastyacihna / the solsticial colure or the star Castor it is evident from the lunar eclipse deciphered by Sengupta that the date of Kāḷidāsa is AD 542. Such a perfect conjunction of Rohiṇi and the Moon in the aftermath of a total eclipse is not available in the vicinity of other dates often credited to Kāḷidāsa.

5. Epoch of Vikramāditya

Outside the domain of the epics perhaps there have been no other king as famous as Vikramāditya, the hero of many legends and fables. Unfortunately, solid evidence in favor of his terrestrial existence had been very little and the mainstream historians remain reluctant to award him a historical status. Vikramāditya, thus remains a puzzle to all. As popularly known by legends Vikraṃ equally distributed his life between the kingdom and the forests by six months each alternatively very much like the solar courses, Uttarāyana and Dakṣiṇāyana. *All* scholars agree that Vikraṃa Saṃvat originally was known by the name Kṛta or Māḷava era that in later times got re-christened as Vikrama Saṃvat due to unknown historical reasons.

Above circumstances inspire the present author to propose that Vikṛamāditya in fact was the last of our solar myths created by the purāṇic tradition. Origin of this myth can be traced on astro-mythological grounds to the period around 263 BC, when the solsticial colure passed through Śṛāvaṇa nakṣatra or Altair (α - Aquilae). For the winter solstice of 263 BC [25^{th} December, 0248] α - Aquilae had the right ascension of 18 –00 and rose at 0552 (Ujjain LMT) almost an hour before sunrise at 0643 and therefore heliacally visible. In Hindu stellar mythology Altair had the appellation Tri-Vikṛama and hence the above epoch received personification as Vikṛamāditya. Etymologically Vi-krama means – 'a step, stride, pace, going, proceeding, ... course, valour, courage, heroism and also it refers to 14^{th} year in the 60-year cycle of Jupiter. Vikṛamāditya, thus means the valour-sun of Ujjain where Ujjain falling in the 24^{th} degree of latitude is the capital of sun in its northern course. The epoch Kali 3044 or 58 BC that has become famous as that of Vikṛama, according to Monier Williams marks the fall of Vikṛamāditya in the battle with the south Indian king Śālivāhana. For Śālivāhana, Monier Williams gives the meaning 'said to be so called either from having ridden on a Yakṣa called Śāli or ... being represented as borne on a cross made of Śāl or other wood'. Vikramāditya's depiction in the legends as a king constantly on the move reflects the solar courses of Uttarāyana and Dakṣiṇāyana.

In 58 BC, Altair was rising at 0605 [Ujjain LMT] against sunrise at 0642 and this situation with sun at 9^0 below the horizon probably made Altair invisible and the phenomenon got depicted as the fall of Vikṛamāditya. α - Lyrae or Vega (known in India as Abhijit or the *Victorius) rising at* 0412 with sun at 33^0 below the horizon probably became the indicator of winter solstice and received the personification as the Victorius Śālivāhana – the cross over which he was born can be found in Cygnus, formed by α, δ, β and ε with γ at their center. Yakṣa, named Śāli is the constellation Lyrae often represented by a Lyre.

These astronomical facts form the only reasonable explanation for the absence of historical information on these legendary kings. It was to fill up the need for an epoch for Vikramāditya that the Mālva era got renamed as Vikram Samvat in later times and interpolation was made in Jyotirvidābharaṇa of Kālidāsa and Bhaviṣyapurāṇa to make him a court poet of Vikramāditya. The original nine gems of Vikramāditya's court most probably are the nine planets. For the winter solstice of 58 BC, Jupiter helically rose at Ujjain at 0506 in Sagittarius to represent the Bhiṣak Dhanvantari, Sun was the astronomer Varāhamihira, Venus at altitude (+) $21^0 35'$ represented the poet Kālidāsa etc. These legendary names were later on adopted and awarded as titles by some later kings and as a result the confusion arose as to the date of the Navratnas of later times as well as those of Vikramāditya.

6. Saptarṣi Cycle – Bogus Astronomical Conception

One of the most intriguing aspects of Indian antiquity and ancient astronomy is the reference to what is known as the Saptarṣi cycle. Saptarṣis or the Great Bear constellation is hypothesized to move one nakṣatra per century leading to a cycle of 2700 years. As quoted by Sengupta, the purāṇic description of the phenomenon is:

"The two front stars of the Great Bear, which are seen when risen at night, the lunar constellation which is seen equally between them in the sky, the Great Bear is to be known as conjoined with that constellation 100 years in the sky. This is the exposition of the conjunction of the lunar constellations and the Great Bear. The Great Bear was conjoined with the Maghās in Parīkṣit's time 100 years".[5]

The Ṛṣis are Marīci, (η - Ursae Majoris), Vasiṣṭhā (ζ), Aṅgiras (ε), Atri (δ), Pulastya (γ), Pulaha (β) and Kratu (α). As discussed by Brennand the great circle passing through the ecliptic and celestial poles – the Solstitial Colure has successively passed through these stars due to precession during the period since 4235 BC. As such the epochs of the different Ṛṣis are:

	Epoch: Summer solstice	Right ascension	Ecliptic sidereal λ
Marīcī (η)	27 July 4235 BC, 0410, LMT	06 – 00 – 09	$152^0 21'$
U.Phalguni or β - Virginis		05 – 59 - 05	$152^0 35'$
Sun		06 – 00 – 00	$151^0 23'$
Vasiṣṭha (ζ) or Mizar	20 July 3388 BC, 1043, LMT	06 – 00 - 09	$141^0 07'$
Aṅgiras (ε) or Alioth	17 July 2913 BC, 0612 LMT	06 – 00 - 09	$134^0 21'$
Atri (δ) or	13 July 2360 BC, 0930 LMT	05 – 59 - 59	$126^0 29'$
α - Leonis or Regulus	13 July 2350 BC, 1940 LMT	05 – 59 –40	$125^0 15'$
Pulastya (γ)	13 July 2324 BC, 0304 LMT	06 – 00 – 00	$125^0 53'$
Pulaha (β) or Merak	07 July 1538 BC, 1507 LMT	05 – 59 – 55	$114^0 51'$
Kratu (α)	05 July 1243 BC, 0153 LMT	06 – 00 – 00	$110^0 37'$

[5] Sengupta quoted from Pargiter's Kali Age, p.59 and 75.

In 1400 BC (1391BC if we take the middle of the α and β epochs), the Solstitial Colure passing between α and β Ursae Majoris at the midpoint intercepted the Mūlādhāra Cakra at $112^{0}34'$. It could not have marked the beginning of Maghā, middle of Maghā nakṣatra or the star Maghā. The "line of the Ṛṣis" would have come into existence only at this epoch to mean the solstitial colure. Without some phenomenal reason it is quite unlikely that the midpoint of the two stars shall assume any significance in astronomy. According to Sengupta, the purāṇic statement may mean that the celestial pole of the time of Parīkṣit lies on the great circle passing through α - Leonis and the middle point of the arc joining α and β Ursae Majoris or right ascension of α - Leonis was equal to the mean of the right ascension of α and β Ursae Majoris. As per this view the line of the Ṛṣis had no connection with the Solstitial Colure and it meant only a phenomenon involving the stars α & β Ursae Majoris and α - Leonis. Had that been the case, there was no reason to hypothesize or conceive a motion of the Saptarṣis through the nakṣatras. If we accept the view of Brennand, the different stars of Ursae Majoris and the nakṣatras of Leo had a successive correlation through the moving line of the solstice and this could have metamorphosed into an imaginary motion of the Ṛṣis through the nakṣatras. According to Sengupta's explanation, the purāṇas mean an apparent phenomenon or relation of the star α - Leonis with α & β Ursae Major instead of the Solstitial Colure passing through them that has no relation to the star Maghā or α - Leonis. The solstitial colure had passed into Cancer or Āśleṣa as early as 1942 BC whereas it touched β - Ursae Majoris only in 1538 BC. So the solstitial colure provide no phenomenal interconnection between the star Regulus and the front stars of Saptarṣis. Without realizing this difficulty scholars might have theorized that the solstitial colure passing between the α & β of Ursae Majoris was passing through the star Maghā or the nakṣatra.

Taking the α -β midpoint as the driver's seat of the great chariot of the Ṛṣis, it corresponded phenomenally to α - Leonis, ζ - Leonis and β - Leonis Minoris in 300 BC with the same right ascension and meridian transit. Obviously, the purāṇic account has its genesis in 300 BC and they have defined it as the epoch of Parīkṣit, perhaps a cycle earlier of the imagined movement of the Ṛṣis: 300 BC + 2700 = 3000 BC and some other adjustments or the search for a super conjunction that marks Yugādi ultimately led them to the 3102 BC epoch of Parīkṣit.

Chronological significance of the Saptarṣis perhaps arises out of the fact that they are representations of the successive epochs and they are mythical personalities or personification of the epochal summer solstices. Vedic tradition has its astronomically recorded beginning with the fall of solstitial colure over Marīcī or η - Ursae Majoris in 4235 BC and it is possible that 'Marīcī' was the name of the astronomer – priest or his clan. Vasiṣṭha marks 3388 BC, when the VII[th] Book of the Ṛgveda was composed. Any other meaning such as a motion of the stellar Ṛṣis through the nakṣatras is a quite absurd proposition devoid of any scientific rationale. The ancient astronomers themselves amply demonstrate this but in recent times certain enthusiasts have been hypothesizing the 'Saptarṣi' movement as a piece of super science wisdom without giving any cognizance to the sky or ancient records. Kamalākara in his Siddhānta Tattvaviveka has stated:

"Sage Śākalya has given the motion of the Sages with their positions in his time... Sūrya

and others who explain the nature of the celestial sphere in their works do not give it and therefore the theory cannot be sustained astronomically... Even today this motion mentioned in the Saṃhitās is not observed by knowing astronomers... Therefore the seven real Sages who are the presiding deities (of these stars) are to be considered to be moving, unobserved by men, for the prediction of the fruits thereof".

It was Brennand in 1896 who offered an explanation for the purāṇic account in terms of solstitial colure that was later on borrowed by different scholars mostly without proper acknowledgement to twist the Saptarṣi theory of the Purāṇas in favor of the history they have concocted. It is evident from the opinion of Kamalākara that any astronomer who have watched the sky would not have believed in such a motion and desisted from using the related references in substantiation of a chronology. TSK Śāstry and KV Śarma[6] have quoted the explanation given by Prof. V. Thiruvenkatācārya, which can be found in the work of Brennand and accordingly the great circle passing through the stars α and β of Great Bear or the midpoint of the line joining them undergoes libration or oscillation with reference to a limited arc of the ecliptic around the star Regulus. This phenomenon neither implies a direct or retrograde motion of the Great Bear through the 27-nakṣatra divisions at the rate of one nakṣatra every hundred year.

7. Yudhiṣṭhira Era

As recorded in Bṛhatsaṃhitā of Varāhamihira, Yudhiṣṭhira era had its beginning 2526 years before the Sakanrpakāla of AD 78. This places the event in 2449 BC. Was this Yudhiṣṭhira a mythical king or a historical figure? Can the epoch of Yudhiṣṭhira be astro-mythological? An answer to these questions are attempted below:

• The fact that Yudhiṣṭhira represents a solar myth that was in evolution since prehistoric times is evident from his genealogy itself. He is the son of Dharma, a variant of Yama who is the lord of Pitrs. The nakṣatra credited to Pitrs is Maghā or Regulus and therefore if some phenomenal reason suggests extra-significance for this star at the epoch of 2449 BC, the presumption that Yudhiṣṭhira is a solar myth related to the nakṣatra of Pitrs gains credence for a detailed examination.

Astronomical data indicate that the summer solstice of 2449 BC coincided with the star Maghā or Regulus and Yudhiṣṭhira is a personification of the same. This personification and the allegorical description of a war of the Bhāratas represent a tradition or paradigm begun around 4000 BC. As already explained in preceding chapters of the present work, the crux of the allegory is calendar conflict between sidereal solar calendar and tropical lunar calendar – the former led by the fiducial star Mūla, personified as Gaṅgāputra Bhīṣma (protector of the clan of Matsya – Kanyā Satyavati) and the latter led by personified cardinal points such as Yudhiṣṭhira etc.

• Winter solstice was exactly on JD [TDT] = 827299.9120881[7] corresponding to Friday,

[6] Śāstry, TSK and Śarma KV, 'The Untenability of the Postulated Śaka of 550 BC', Journal of Indian History, Vol. XXXVII, PP.201 –224, 1959.

[7] Planetary positions: on JD [TDT] = 827299.9120881

8th January 2448 BC, 1512 UT. Bhīṣma has spoken in the Anuśāsana parva: " It is good luck, O, Kaunteya Yudhiṣṭhira, that you have arrived with the ministers. Sun has turned back; I have been on this bed of arrows for the last 58 days... O, Yudhiṣṭhira, three – fourths of Māgha is now over and now the light half prevails". As Bhīṣma fell on the 10th day of the battle, the beginning of the starry war can be determined as winter solstice – (58+10) days = JD [TDT]: 827231.9121, which correspond to Sunday, November 01, 2449, 1718 UT. If we take the day as the first for JD 827230.5, Sunday, 1st November 00:00 UT, the battle calendar can be deciphered as:

War Event	JD/Date	Tropical λ	Sidereal λ	Tithi/Nakṣatra
War Beginning	827230.5, Sunday, November 1	Sun: 200°15', Moon: 337°44'	237°12' 14°41'	12 Aśvini/Bharaṇi
	827232.5 Tueday, November 3	Sun: 202°18' Moon: 01°30'	239°15' 38°27'	14 Kārttika
	827233.5 Wednesday, 4th Nov.	Sun: 203°19' Moon: 13°22'	240°16' 51°49'	15 Rōhinī
10th Day	827239.5, Tue, 10th November	Sun: 209°27' Moon: 85°59'	246°24' 122°56'	20 Maghā
	827241.5 Thursday, 12th Nov.	Sun: 211°30' Moon: 111°32'	248°27' 148°29'	22 U.Phālguni
	827242.5 13th November	Sun: 212°30' Moon: 124°47'	249°27' 161°44'	23 Hasta
14th Day	14th November	Sun: 213°32' Moon: 138°26'	250°29' 175°23'	24 Hasta/ Citrā
	16th November	Sun: 215°35' Moon: 167°03'	252°32' 204°	26 Viśākhā
18th Day	18th November	Sun: 217°38' Moon: 197°05'	254°35' 234°02'	29 Jyeṣṭhā
	20th November	Sun: 219°40' Moon: 227°26'	256°37' 264°23'	1 Abhijit
68th / 69th Day	Saturday, 9th January 827299.5	Sun: 270°22' Moon: 159°20'	307°19' 196°17'	21 Svāti
	11th Jan. 2448 BC 827300.5	Sun: 271°22' Moon: 173°20'	308°19' 210°17'	22 Viśākhā
	12th Jan. 2448 BC 827301.5	Sun: 272°22' Moon: 187°29'	309°19' 224°26'	23 Anurādha/ Jyeṣthā

Planets	Tropical λ	Sidereal λ	War 1st Day
Sun	270°00'	306°57'	200°15' λ
Moon	154°15'	191°12'	337°44'
Mars	203°08'	240°05'	156°32'
Mercury	263°29'	300°26'	216°01'
Jupiter	04°59'	41°56'	07°50'
Venus	285°31'	322°28'	199°35'
Saturn	356°31'	33°28'	357°51'

Data given above suggests that the old sidereal solar calendar and year beginning represented by Bhīṣma, which had its year beginning on 4th November with the solar month of Dhanu or Mārgaśīrṣā/ lunar month that began on 20th November with new moon[8] near Abhijit was discarded (11th January sunset) and the lunar tropical calendar with winter solstice as the beginning was adopted on 12th January 2448 BC when Moon was conjoined Antares or Jyeṣṭhā Rōhiṇī on Kṛṣṇa (8) tithi. This cannot be the light half of the month as indicated in the above quoted words of Bhīṣma that may be a result of the corruption of the original verse – "Tribhāgaśeṣaḥ pakṣō*f*yaṃ kṛṣṇōbhavitumarhati".

A complete and perfect description cannot be expected in the epic verses due to the corruption and interpolation the text might have undergone over vast period of time till it was finally redacted around 900 BC or even later. Also it is possible that the war diary given in the epic may contain details of different calendar conflicts that might have taken place in antiquity. The three epochs identified in this present work respectively correspond to:

• Summer solstice on β - Virginis: Kalāṣṭmi of 25th July 4135 BC, 2354 LMT of New Delhi, which got personified as Kṛṣṇa

• Summer solstice on α - Leonis: 2449 BC, got personified as Dharmaputra

• Summer solstice on δ - Cancri: 964 BC, became Puṣya epoch of both Rāmāyaṇa and Mahābhārata

War in fact is an allegorical description of the solar / lunar month of Mārgaśīrṣa and at different epochs this transit occurs with some common factors/variant features and hence the diary we have in the epic is most likely a mix up of the different epochal descriptions of the sidereal versus tropical conflict. In 2449 BC the solar transit over Mūla coincided with the full moon on Alcyone and the 18 days ended with Moon near Abhijit or Vega, the jewel that adorned Aśvatthāmā in exchange of which the Pāṇḍvas spared his life. In this cycle Moon had its apogee at $\lambda = 326^0 37'$ [sidereally $03^0 34'$, in Aśvini nakṣatra] and perigee at $170^0 51'$ [sidereally $207^0 48'$ in Viśākhā] and so Moon could cover only up to Abhijit in 18 days. At some other epochs moon could have transited between Alcyone and Altair in 18 days by a different profile of speed. A unique epoch answering to all the epic astronomical references is an impossibility as pointed out by different scholars. Further, it is important to note that the heroes of the war are all celestial and not terrestrial and so they can be located only in the astronomical history or precessional phenomena over the zodiac and not on the terrestrial Bhārat. "Bha-ratas" lived on the stars and the epic is an account of the ancient star wars. It is the mix up of the different epochal

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[8] New moon dates are: Kārttikā beginning: JD [TDT] = 827220.2786353, Tuesday, 20th October 2449 BC, 00:00 UT, with sun and moon at $189^0 01'$[$225^0 58'$]. Lunar Mārgaśīrṣā beginning: JD [TDT] = 827249.7268579, Thursday 19th November 1045 UT with Sun and Moon at $219^0 06'$[$256^0 03'$]. On 11th November 22:44 UT, JD[TDT] = 827241.4469798, Moon was conjoined Rāhu at $\lambda = 100^0 46'$ [$137^0 43'$]. No eclipse was therefore possible during the war. Full moon of Kārttikā: Wednesday, 4th November, JD [TDT], 2156 UT; JD [TDT]: 827235.1929238

descriptions that allow variant interpretations – as for example the epoch 2449 BC has no eclipses to answer the epic references of the death of Jayadratha or the prewar evil omens.

Examination of the astro-mythological aspects requires the relevant astronomical data of the epochs such as the equinoxes and solstices along with the stellar and planetary phenomena. Details are given for reference to those who are interested in interpreting the epic story in terms of the astronomical phenomena.

Vernal equinox

10th April 2449 BC, 1444: JD [TDT]: 827025.89962, Sunrise:0603, Sunset: 1810 LMT. At 0500 LMT, the great square of Pegasus [α - Pegasi: (+) 42°06', 124°07'; Alpheratz or α - Andromedae: (+) 33°54', 100°34'] γ - Andromedae [(+) 16°49', 77°46'], Pisces and Venus [altitude:(+) 13°08', azimuth: 118°39', risen at 0352,]; Hamal or α - Arietis [(+) 07°33', 94°24', risen at 0424]; Mirfak or α - Persei [(+) 08°51', 63°47', risen at 0412] 41 – Arietis (+) 01°26', 86°02' (rising 0453) and β - Arietis (+) 08°38', 98°09' could be seen in the east. Sun was (-) 14°43', Alcyone or η - Tauri at (-) 11°14, 80°43', rising 0549;Mercury (-) 02°57' (rising at 0511); Jupiter and Saturn heliacally set at (-) 12°03' and (-) 12°43', α - Aurigae (-) 06°11' respectively below the horizon.

On the western sky α2 – Librae [(+) 05°49', 275°18', setting at 0528], Antares or α - Scorpii [(+) 16°36', 252°15', setting at 0620], Arcturus [(+) 18°16', 312°24'] etc., were visible. Moon had dipped below the horizon at 0449. On 9th April at the time of sunset (1810), Moon [(+) 36°59', 90°23'] was in conjunction with Spica [(+) 37°14', 95°35'] on the east. On 10th April at sunset Moon was approaching α2-Librae. α - Persei was to set at 1824, azimuth 303°34', and at 1840 (half-an-hour after sunset) Mars was [(+) 16°57', 272°32', setting at 2000] visible in between Orion and Aurigae, below Gemini and α - Leonis [transit 1800] was almost on the meridian. Full moon was on 12th April 0255 near α - Scorpii.

Summer solstice

13th July 2449 BC, 19:35. JD [TDT]: 827120.1015, Sun: Altitude (-) 08°31' & Azimuth 303°12'. Sunset:1855 LMT of New Delhi. α - Leonis setting time: 1849, altitude: (-) 09°22', azimuth: 304°07'. Ayanāṃśa = 36°57'. On the east Cassiopeiae, Pegasus, Aquarius and Piscis Australis were rising with Cepheus, Cygnus, Delphinus, Aquilae and Capricorn above. 14th July [0455 LMT] at sunrise Mars was heliacally set and Venus could be seen above δ - Cancri along with the Dogs. One hour earlier [0355], sun [(-) 12°03', 54°02'] was 12° below the horizon and Venus, Procyon, Gemini, Aurigae, Orion, Jupiter, Saturn, Perseus etc., could be seen. Moon was exactly on the meridian (approaching Aries) and γ - Andromedae was approaching its transit at 0407. Aquilae, Delphinus, Pegasus, Cygnus and Cepheus dominated the western sky. Ursae Major, Draco, Hercules were visible in the north and Orion, Eridanus, Cetus in the southern sky.

Autumnal Equinox

12th October 2449 BC, 04:39 LMT: JD [TDT] = 827212.47889:Sun was (-) 17^{0}28' [rising 0555] below the horizon, Mars [(+) 19^{0}09', 82^{0}30'] in conjunction with Spica [(+) 19^{0}37', 85^{0}51'], with Bootes towards north and δ - Cancri was culminating at 0420. Moon transited the meridian at 0408 and was in Puṣya. On the west γ - Andromedae [(+) 03^{0}23', 289^{0}14'] setting at 0457] and Cassiopeiae were preparing to dip below the horizon with Perseus above and Taurus between Orion and Aurigae, holding Saturn (close to $\lambda = 0^{0}$) and Jupiter. In the North α - Draconis or Thuban had an altitude of (+) 27^{0}34' and azimuth 02^{0}01'; β [(-) 0^{0}56'] and γ [(-04^{0}23') Draconis were below the horizon. In the south Canopus [(+) 06^{0}23, 178^{0}19', at sunrise 0555 LMT altitude was (+) 05^{0}18'] had the company of Velorum, Puppis, Canis Major, Lepus and Orion above in order towards east.

After two days on 14th October Moon was in conjunction with Regulus presided over by Pitrs. δ - Scorpio [(-) 17^{0}08', 82^{0}30'] was conjunct sun, α2 – Librae had risen at 0434 [(+) 00^{0}49', 81^{0}52'], Regulus or α - Leonis was [(+) 74^{0}30' 101^{0}51', transit 0545] along with Moon [(+) 73^{0}35', 107^{0}01', transiting at 0548] in the eastern sky.

Winter solstice

2448 BC Jan 08 15:53, Eastern sky at 0600 LMT (New Delhi) had sun at (-) 13^{0}05' and Mars [(+) 46^{0}33', 143^{0}40'] near Mūla (λ - Scorpii), Aquilae at (+) 24^{0}34', 93^{0}42', Antares was to have its transit at 0636, Capricorn, Hercules, Sagittarius, Opheucus, Scorpio etc could be seen. In the northern sky was Ursa Major, Draco & Ursa Minor and Cepheus had above them Bootes, Hercules and Lyrae. And south had Pavonis, Arae, Centarus, Acrux, Velorum and parts of setting Carinae.

8. 3138 BC – Fictitious Year of Bhārata War

Relying on Āryabhaṭa tradition and the Aihole inscription there have been many scholarly attempts to prove that the year 3138 BC – 36 years prior to Āryabhaṭa's Yugādi meets the requirements of war diary recorded in the Mahābhārata. This is an absolutely false claim as is evident from the following facts:

⇒ I could see a work that claims to have dated the Mahābhārata war astronomically.[9] For Kṛṣṇa's date the horoscope given by BV Raman for the date 19th July 3228 BC is wholly reproduced with the additional information that he was born on a Wednesday. Actually, the weekday is Saturday midnight and the horoscope given proves nothing about the truth of the purāṇic account. Śrāvaṇa Kṛṣṇāṣṭami of any other year can be paraded as the true birth date of Kṛṣṇa as the author of this work has done: To quote:

"*For the above horoscope worked out for this date for the time computed for Mathura where Kṛṣṇa was born, we get the corroboration of the following combination of all the elements of Hindu Pañcāṅga as furnished by Harivamśa, Viṣṇupurāṇa and by Garga Maharṣi namely:*

[9] Dr. E. Vedavyas, IAS, Ph.D., Astronomical Dating of the Mahābhārata War, Vedavyāsa Bhārati University of Vedic Sciences, Śrīparvatam. Gowripatnam, A.P

(1) The day was Aṣṭami tithi
(2) Dark fortnight (Bahuḷa pakṣa)
(3) Of the Śṛāvaṇa lunar month, on which falls the
(4) Rohiṇi star (4th pāda of which was current at the time of birth)
(5) It happens to be Abhijit muhūrta
(6) The Moon was in Lagna indicating the birth was at Moon-rise
(7) The day of the week was a Wednesday
(8) And all these combination occur in the year 'Śṛīmukha', 125 years 7 months before Kaliyuga"

Epoch: Saturday, 19th July 3228 BC, 1849 UT: JD [TDT] = 542597.40281
[Ayanāṃśa: $47^0 38'$]

Planets	Tropical λ	Sidereal λ	For BVR ayanāṃśa = $50^0 40'$
Sun	$90^0 01'$	$137^0 39'$	$140^0 41'$
Moon	$00^0 40'$	$48^0 18'$	$51^0 20'$
Mars	$45^0 00'$	$92^0 38'$	$95^0 40'$
Mercury	$103^0 48'$	$151^0 26'$	$154^0 28'$
Jupiter	$103^0 08'$	$150^0 46'$	$153^0 48'$
Venus	$57^0 07'$	$104^0 45'$	$108^0 34'$
Saturn	$178^0 43'$	$226^0 21'$	$229^0 23'$
Rāhu	$57^0 44'$	$105^0 22'$	$108^0 24'$
Śikhi	$237^0 44$	$285^0 22'$	$288^0 24'$

This data proves nothing of the sort claimed by the author. The date has been traced with the stipulation that it must be Śṛāvaṇa Kṛṣṇāṣṭmi of the 126th year counted backward from 3102 BC – and it is only accidental that at midnight Rohiṇī prevailed. Such prevalence of Rohiṇī alone allows no unique determination of the date. Innumerable years satisfy all the above conditions of Śṛāvaṇa Kṛṣṇāṣṭmi. Either the author is ignorant of the subject or he has made a deliberate attempt to fool the public – that is the fact apparent in the above quoted words. Śṛāvaṇa Kṛṣṇāṣṭmi of almost every year will have the factors that the author has mentioned except the weekday and here also the day is different than what he says.

⇒ Year of War 3138 BC, 3139 BC?

To avoid the one-year confusion I am providing the relevant data for both the years to prove beyond doubt that neither of these years satisfies the war diary given in Mahābhārata:

→ War Year 3138 BC?

Winter solstice of 3137 BC was on Wednesday, 14th January, 02:27 UT: JD [TDT] = 575647.67821 with sun at 270^0 and moon at $247^0 07'$. According to Mahābhārata, this has to be either Śuklāṣṭami or Kṛṣṇāṣṭmi on Rohiṇī nakṣatra. Ayanāṃśa for Mūlādhāra Cakra being $46^0 23'$, moon was over Dhaniṣṭhā instead of Rohiṇī.

Going back by 68 days we reach Friday, 7^{th} November 02:27 UT, 3138 BC for which the planetary sidereal positions $\{\lambda+46^0 23'\}$ were: Sun: $247^0 31'$, Moon: $115^0 12'$, Mars: $73^0 45'$, Mercury: $225^0 54'$, Jupiter: $05^0 51'$, Venus: $251^0 24'$, Saturn: $251^0 55'$, Rāhu: $155^0 19'$. This data has no agreement with the planetary positions given in Mahābhārata.

Nearest Amāvāsya is on Monday 17^{th} November (JD [TDT] =575590.452522) for which the Sun and Moon were sidereally at $258^0 32'$ – on Pūrvāṣāḍhā nakṣatra. 68 days ahead of this amāvāsya takes Sun to $280^0 42'/327^0 05'$ ($\lambda_{tropical}/\lambda_{sidereal}$) and Moon to $32^0 59/ 79^0 22'$ (Ārdra last degree).

→ War Year 3139 BC?
Winter solstice: Monday,13^{th} January 20:58 UT, 3138 BC: JD [TDT] = 575282.45: Sun = 270^0 and Moon = $110^0 12'$. Moon was on Uttaraphālgunī, instead of Rōhiṇī.

On tracing back 68 days we reach 6^{th} November (2058 UT) 3139 BC having Sun: $201^0 09'$ / $247^0 32'$, Moon: $305^0 59'$ / $352^0 22'$ (Revatī), Mars: $186^0 30'$ / $232^0 53'$, Mercury: $184^0 52'$ / $231^0 15'$, Jupiter: $285^0 25'$ / $331^0 48'$, Venus: $248^0 07'$ / $294^0 30'$, Saturn: $195^0 43'$ / $242^0 06'$ and Rāhu: $130^0 03'$ / $176^0 26'$ [All positions given as $\lambda_{tropical}/\lambda_{sidereal}$].

Nearest new moon was on 29^{th} October 3139 BC, (JD [TDT] = 575206.35363), with the Sun and Moon at $192^0 52'$ / $239^0 15'$. Moving 68 days ahead we reach Sunday January 5, 1839 UT, having Sun = $261^0 56'$ / $308^0 19'$and Moon =$09^0 27'$ / $55^0 50'$. This date correspond to Rōhiṇī, but the sun was short of winter solstice by 8 days.

This data rules out any historical connection between the events described in Mahābhārata and the Deluvial Epoch of 3102 BC. Above said author has placed Rāhu in Vṛścika and suggested an eclipse at the beginning of the war with sun and moon in Jyeṣṭhā at 240^0. In reality Rāhu was 2 rāśis away in Kanyā. Further, on page 138 of his book, Sun's position at Uttarāyana is computed as $240^0 + 68 = 308^0$. This in turn means that ayanāṃśa of the epoch is 38^0 where as the author has used an ayanāṃśa of $50^0 40'$ for computing Kṛṣṇa's horoscope of 3228 BC. Ayanāṃśa of 38^0 demands the epoch to be around 2449 BC as found out by.Sengupta.

9. Vedic Connection of Bhārata Episodes

Mahābhārata has got history encrypted astronomically and as such it can never be understood with reference to the terrestrial dimension. The war diary portrays the astronomical phenomena beginning with the zodiacal sign of Sagittarius (Dhanu), the Archer and ending with the winter solstice – primarily it is the story of a sidereal versus tropical calendar conflict. Mārgaśīrṣādi calendar got replaced by the solsticial calendar and the related astronomical phenomena finds an allegorical description in the Mahābhārata. In framing this allegorical story the ancient legends were ably put to use

and that is why we are able to find the shadow of certain Bhārata episodes in some Vedic verses:

→ Ṛgveda: VII.19.2: "Thou, verily, Indra, gavest help to Kutsa, willingly giving ear to him in battle. When, aiding Ārjuneya, thou subduedst to him both Kuyava and the Dāsa Śuṣṇa".

Considering this verse as an example, this occurs where Indra's valorous deeds as Maghavan are described. As shown by Sengupta, Indra became Maghavan when the star Maghā had its heliacal rise to mark the summer solstice. This is an astronomical event of 4000 BC involving the nakṣatra Uttara Phālgunī, having the appellation Arjuna and has nothing to do with any terrestrial hero of that name. Hymn preceding the above has as 4th verse: "Vasiṣṭha hath poured forth his prayers, desiring to milk thee like a cow in goodly pasture. All these my people call thee Lord of cattle; may Indra come unto the prayer we offer". Griffith has provided a note about Vasiṣṭha: 'the Ṛṣi of the hymn and the chief priest who had accompanied the warlike expedition of Sūdas'. It is simply nonsense to consider this as connected with any terrestrial war. The hymn belongs to the epoch when the solsticial colure passed over Vasiṣṭha (the star Mizar (ζ - Ursae Major)) – 3388 BC or around this time.

Kutsa is described as son of Ārjuni in verse I.CXII. 23, which is a prayer addressed to the Aśvins and in no way it reflects the terrestrial hero of Mahābhārata. Hymn IV.16 mentions: 'Kutsa longed eagerly to win thy friendship' and also describes Śūṣṇa as the enemey of the harvest. Vedavyas has mentioned a few more verses as referring to the historical events of Mahābhārata but in neither even the name is in agreement. 'One five for five brothers' is most likely an allegorical reference to the moon and five seasons and is in no way connected with the terrestrial Pāṇdavas. Pāñcāli and Pāṇḍavas originally was an allegorical description of the 19-year cycle constituted of the five different kinds of years as we now find described in the Vedāṅga Jyotiṣa. In a preceding section we have already seen that the Puṣyaparva is an allegorical description of the epoch 964 BC and this is much posterior to the Vedic period that has been dated astronomically to be 4000 – 3000 BC.

10. Other Indications of Epoch in War Diary

It is nothing but a paradox that Kṛṣṇa of the epic wields an invincible Cakra while his elder brother Balarāma known also as Halāyudha is poorly equipped with a plough even in war. According to Monier Williams Hala means both the plough and as well as a land measure and with this information when we turn our attention to the skies, the Plough – Man who *measures out the celestial land can only be the Moon. His younger brother is the Sun,* especially of the summer solstice and his profile given in the Mahābhārata covers solsticial phenomena of the period 4136 – 964 BC. Considering 964 BC with the solstices at $286^{0}32'$ and $106^{0}32'$, the solsticial constellations will be Śṛāvaṇa and Puṣya – and we can find a reflection of this fact in the 42-day pilgrimage of Balarāma beginning with Puṣya and ending on Śṛāvaṇa. War too is an allegorical description of the Moon's transit from Mūla to Śṛāvaṇa as is proved below with the planetary data:

• **Relevant Astronomical Phenomena**

→ Spring equinox: 30^{th} March 0830 UT: Moon ($109^0$48') was sidereally at $126^0$20' – conjunct Maghā. According to the Vedic tradition equinox marks the middle of the spring season.

→ Summer solstice: 2^{nd} July 1432 UT: Moon ($277^0$24') was sidereally at $293^0$56' – conjunct Dhaniṣṭhā. Beginning of rainy season.

→ Autumnal equinox: 2^{nd} October 0630 UT: Moon ($36^0$42') was sidereally at $53^0$14' – conjunct Rohiṇī nakṣatra. Marked the middle of Śarad season

→ Winter solstice: 29^{th} December 1700 UT: Moon ($126^0$51) was sidereally at $143^0$23' – conjunct Uttaraphālgunī. Beginning of winter.

• An important landmark in the epic description of war is Kṛṣṇa's meeting with Karṇā on – "Kaumude māsi Revatyāṃ śaradante Himāgame". Day referred to is Revatī nakṣatra of Kārttika month – Kārttika of 964 BC began with the new moon of 13^{th} October 0710 UT (JD [TDT] = 1369608.101) with the sun and moon at $191^0$09' / $207^0$41' – at the middle of Viśākhā or Rādhā.

→Full moon was on Thursday, 28^{th} October 1825 UT: JD [TDT] = 1369623.5698. Moon ($26^0$51') was on Rohinī ($43^0$23'). On early morning of Thursday Moon was near Kṛttikas.

→ On 25^{th} October Monday at sunrise (New Delhi: 0619LMT), Moon ($341^0$15' / $357^0$47') was conjunct Revatī.

• According to Kṛṣṇa:

Saptamāccāpi divasādāmāvāsyā bhaviṣyati I
Saṃgrāme yujjatāṃ tasyāṃ tāṃ āhuḥ śakradevatāṃ II

[Udyōgaparva: 142.18]

"From the seventh day from to day amāvāsya occurs and the fight is to begin on that day of Indra".

The day in question is 5^{th} November with Sun ($214^0$16' / $230^0$48') and Moon ($124^0$48' / $141^0$20') – Kṛṣṇāṣṭami.

• Amāvāsya on Jyeṣṭhā: 11^{th} November 0619 LMT of New Delhi: Sun = $220^0$24' / $236^0$56' and Moon = $210^0$18' / $226^0$50'.

• Bhīṣma in Command for 10 days

	Date of November	Sun λ+ Ayanāṃśa	Moon λ+ Ayanāṃśa	Nakṣatra of Moon
1	12	237°57'	240°49'	Mūla
2	13	238°58'	254°32'	P.Āṣāḍhā
3	14	240°	267°55'	U.Āṣāḍhā
4	15	241°01'	280°58'	Śṛāvaṇa
5	16	242°02'	293°40'	Dhaniṣṭhā
6	17	243°04'	306°03'	Śatatārak
7	18	244°05'	318°11'	
8	19	245°06'	330°07'	P. Bhadra
9	20	246°07'	341°57'	U. Bhadra
10	21	247°09'	353°46'	Revatī

As we have discussed earlier Bhīṣma was personification of Mūla - as is evident from the fact that he is portrayed as Gaṅgāputra - the invincible Archer. He had his fall on the 10th day of war at sunset – 21st of November. Bhīṣma's 10 –day command is the portrayal of the astronomical phenomena involving Moon and the sign Sagittārius. See the following data:

Date of November	Sunset New Delhi	Moon's transit	Mars transit
19	1715	1807	1914
20	1714	1851	1912
21	1714	1934	1909

It is evident that as Moon culminated on the 21st of November, the Archer had gone below the horizon completely and this observation formed the basis for the portrayal of the great Archer. Mars who had an invisible conjunction with Moon in Revatī during early hours of 21st November, probably received portrayal as Karṇa – disallowed by the grandsire from taking part in the war till his fall.

• Balarāma highlights the epochal significance of Puṣya and Śṛāvaṇa

Catvārimśadahānyadya dve ca me nisṛtasya vai I
Puṣyeṇa saṃpṛayātōsmi Śṛavaṇe punarāgataḥ II

[Mahābhārata, Śalyaparva: 34.6]

"Fourty days and two more have elapsed since I left on Puṣya and now I have returned on Śṛāvaṇa".

These verses respectively spoken by two important characters of the epic are contradictory to each other: A war that began on Jyeṣṭhā-amāvāsya and continued for 18 days cannot end on Śṛāvaṇa nakṣatra. This discrepancy can be explained objectively only if we bring the allegorical side of the epic drama.

• Discontinuity in the War schedule

Had the war schedule be continuous, the 18th day of war would have been on Āśḷeṣā instead of Śṛāvaṇa nakṣatra as being mentioned by Balabhadra Rāma. If the 18th day of war had to be on Śṛāvaṇā, the war diary of the epic may be based on the 8-day interval that precedes Moon's transit of Śṛāvaṇa i.e., from Svāti onwards: 6th to 13th December. This fact may be verified by contrasting the astronomical phenomena of this period with the allegorical war description given in Mahābhārata. The following astronomical factors are noteworthy in this regard:

⇒ Mars occupied Mīna rāśi and Saturn was in Tulā – these two dire maleficent planets (astrologically) were in the southern-half of the sidereal zodiac, Mūlādhāra Rāhu – Śikhi Cakra. The six rāśis from Meṣa to Kanyā were probably regarded as the heavenly world and the latter six the terrestrial or south. The war has been depicted as terrestrial and as such Moon's transit over the southern half only was taken to frame the allegory.

⇒ 11th Day of War: 6th December

War began with the heliacal rising of Mūla, the beginning point of Dhanu rāśi – personified as the Archer Dṛōṇa. Mūla rose at 0511 LMT at New Delhi when Sun's altitude was (-) 19^{0}24'. Sunrise was only at 0640 and so it's evident that heliacal rising of Mūla received the allegorical description as the beginning of war. Sun = 245^{0}57' / 26229', Moon = 178^{0}12' / 194^{0}44'. Another remarkable observation is that true Rāhu was sidereally at 194^{0}10' and Saturn at 195^{0}38' – thus Moon was exactly over the ecliptic as was nearly the case with the time of Bhīṣma's fall. Moonrise at 0117 LMT was along with Centarus on the east and over the western sky Aries, Head of Cetus, Andromedae, and Cassiopeia were about to dive below the horizon.

⇒ 12th Day of the War: 7th December

Moon rose at 0219 and over the western sky, Aries, Head of Cetus, Andromedae, and Cassiopeia had already gone below the horizon. These are the warriors who died at the hands of Dṛōṇa and Rādheya Karṇa on the previous day. Mūla rose at 0507 LMT with Sun at (-) 2021' altitude and on the east could be seen Hercules, Vega, Opheucus, and Scorpio etc.

⇒ 13th Day: 8th December

Moon rose at 0320 LMT at New Delhi and on the east the situation was almost the same as the previous day. But on the west Taurus, Orion, Perseus, Aurigae etc were about to fall below horizon. As Dṛōṇa rose at 0504 Moon's altitude was only 20^{0}26' – a little above

Antares. Vega or Aśvatthāman had his rise at 0440 LMT. Looking at the sky, only Rohiṇī, about to set at the time of moonrise matches the profile of Abhimanyu given in the epic.

14th Day: 9th December: Death of Saindhava King Jayadratha

As Mūla rose at 0459 LMT, Sun was at an altitude of (-) 22°21' and Moon at altitude of (+) 07°11'. On the west α - Aurigae was setting at 0504 LMT. *Moonrise was at 0420, when on the western sky Aurigae had just touched the horizon with iota setting at 0422.* It is this observation that became the death of Jayadratha on the 14th day. Sindhudeśa is the precincts of Ākāśa Gaṅgā (Sindhu) and the king Jayadratha is Aurigae or its principal star α. Orion too was setting – may be deciphered as Ghaṭōtkaca.

15th Day: 10th December

Moonrise was at 0520 and Mūla then had an altitude of (+) 04°10'. Sun (λ) = 249°58' (sidereally at 266°30') and altitude = (-) 18°03'. Moon (λ) = 232°29' (sidereal λ = 249°01'). Tithi was Kṛṣṇa (28.5) and the moonrise is described in the following words in Mahābhārata:

Haravṛṣōttamagātrasamadyutiḥ smaraśarāsanapūrṇasamaprabhaḥ I
Navavadhūsmitacārumanōharaḥ pravisṛtaḥ kumudākarabāndhavaḥ II

[Mahābhārata: Drōṇaparva]

"Moon, shining like the head of Hara's Bull and the Cupid's bow was radiating luster like the pleasant smile of a bride".

Data given substantiate the rising moon as crescent with sharp horns like those of a bull and above was Mūla who is Hara himself and therefore the simile was quite appropriate. Moon of Dhanu got personified as another fierce warrior Dhṛṣṭdyumna who killed Drōṇa; and Aśvatthāman or Vega later on killed Dhṛṣṭdyumna.

16th, 17th, 18th Days: 11th - 13th December

New moon over Pūrvāṣāḍhā on 11th December and then over Uttarāṣāḍhā and Sṛāvaṇa. Karṇā, Śalya and Aśvatthāmā were shaped out of these phenomena. In a preceding section on the same topic I have already discussed in detail the astro-mythical aspects of the portrayal of Aśvatthāmā and Śalya and the same applies here too. In a preceding section on the same topic I have already discussed in detail the astro-mythical aspects of the portrayal of Aśvatthāmā and Śalya and the same applies here too. On 13th December, sunset was at 1710 and moonset was at 1905 on Śṛāvaṇa. As moon was setting Altair and Aquilae had already set at 1851and Āśḷeṣā was rising on the east. At 1935 Jupiter rose along with Maghā or Regulus to represent Yudhiṣṭhira. Planetray positions at sunset of the 18th day of war also have some notable significance:

13th December 964 BC, 1710 LMT of New Delhi

Planets	Tropical λ	Sidereal λ
Sun	253°32'	270°04'
Moon	278°08'	294°40'
Mars	346°44'	363°16'
Mercury	236°13'	252°45'
Jupiter	108°52'	125°24'
Venus	245°48'	262°20'
Saturn	179°35'	196°07'
Rāhu	177°38'	194°10'

Sun was precisely at the endpoint of Dhanu rāśi and beginning of Makara. Rising Jupiter was conjunct Regulus or Maghā presided over by Pitṛs and the nodes Rāhu & Śikhi occupied the 15th degree of the rāśis Libra and Aries of the Rāhu – Sikhi Cakra or Sidereal Zodiac. No far-fetched imagination is required to see Yudhiṣṭhira (Dharmaputra) in Jupiter rising with Regulus or Maghā of Pitṛs at the end of the War.

• Conflicting Winter Solstice

The major conflict between epic description of war and the astronomical phenomena comes in respect of winter solstice. According to the epic sun turned Uttara 50 days after the war whereas here we find it just after 16 days. Arithmetic of the number of days agree with each other only if we consider the war as continuous – ending on Āśleṣā nakṣatra of Suyōdhana. The date will be 30th November and winter solstice will be after 29 days instead of 50 days. On the other hand, when we pass the 68 days from the new moon of Thursday November 11, we reach Tuesday January 18, 963 BC having Sun in the 7th degree of Kuṃbha and Moon over Rohiṇī nakṣatra – as demanded by the epic. But the date is 21days after winter solstice – wherefrom comes this discrepancy?

We must note that the details such as new moon near Antares at the beginning of the war and other astronomical indications are all correct including Rohiṇī nakṣatra on the 69th day but the winter solstice has fallen short by 21 days. This 21 days arise out of precession – the original allegorical war description had its genesis at an epoch earlier by "21 days of precession" or 1512 years i.e., 964 + 1512 = 2476 BC.

• Shift of Epoch – Answers Another Conflict

Sengupta[10] has added the following note with reference to the verse 'Māghōƒyam samanuprāptō māsaḥ saumyō Yudhiṣṭhiraḥ I Tribhāgaśeṣaḥ pakṣōƒyaṃ śuklō bhavitumarhati II ' over which we consider demise of Bhīṣma on śukḷa(8) falling on Rōhiṇi (Aldebaran) viz., Bhīṣmāṣṭami:

[10] Ancient Indian Chronology, p.9

"The original word in place of Śukḷa was perhaps Kṛṣṇa and a subsequent redactor changed the word to Śukḷa, to bring out the approved time for the death of Bhīṣma. Nīlakaṇṭha, the commentator of the Mahābhārata quotes a verse from Bhārata Sāvitri, which also says that "Bhīṣma was killed by Arjuna on the 8th day of the dark half of Māgha": see Bhīṣma parva, ch.17.stanza 2. In an edition of the Bhārata Sāvitri, the verse runs as 'Bhīṣma was killed in the month of Agrahāyaṇa on the 8th day of the dark half'. This of course refers to the day on which Bhīṣma fell on his "bed of arrows": 58 days after that, i.e., exactly one day less than full two synodic months becomes the seventh day of dark half of Māgha. Hence also Bhīṣma expired in the dark half of Māgha and not in the light half'.

It is apparent from the above words that scholars forced to allege interpolation vis-à-vis dishonesty / carelessness / confusion on the side of redactors without giving any inspiring reasons thereof. Why should an interpolator change Kṛṣṇō to Śukḷō without sufficient inspiring reasons? The only possible reason is redaction at a similar epoch but differing in certain details and the consequent confusion and adoption of what they have observed in favor of the earlier. Here it can easily be understood that the redaction of war diary in 964 BC was unscientific and precession was not properly accounted for and hence the 21 days discrepancy in the case of winter solstice and the fall of Bhīṣmāṣṭmi on Śukḷa (8) instead of Kṛṣṇa (8).

The epoch that we reach on accounting for the 21 days of precession 2476 BC, answers the problem clearly:

• Winter solstice: 9th January 2475 BC, 0133 UT: JD [TDT] = 817438.35421: Sun =270^0 and Moon = 178^{0}15'. Ayanāṃśa = 37^{0}19'. Sidereal longitude of Moon = 215^{0}34'. At 1800 UT Moon had a longitudinal conjunction with Antares [JD[TDT] = 817439.039, Moon had a south latitude of more than 5^0] and this matches well with the version that puts Bhīṣma's demise on Kṛṣṇāṣṭami.

• Going 68 days back we reach: 2nd November 1800 UT having Sun = 201^{0}36' and Moon = 10^{0}02'. Sidereally these positions are respectively = 238^{0}55' and 47^{0}21'. After 18 days of war we get 19th November sunset at 1726 LMT of New Delhi and Sun = 218^{0}45'; Moon = 237^{0}34'. Sidereally Sun was at 256^{0}04' and Moon at 274^{0}53'. Or, if the war is considered from 3rd November, on 20th November we get sidereal sun and moon respectively at 257^{0}05' and 288^{0}59'.
Here the war calendar will be similar to the one given by Sengupta – **the war didn't begin on Amāvāsya as was mentioned by Kṛṣṇa**. For 19th October Tuesday 1543 UT: JD [TDT] = 817356.9446, new moon was at λ = 187^{0}12', sidereally at 224^{0}31' – precisely over Antares as demanded by the epic.

• No War Beginning With the Amāvāsya

In 2476 BC, no cognizance need be given to Balarama's pilgrimage across Puṣya and Śṛāvaṇa – an interpolation of 964 BC. Here the solsticial colure passed through ε - Pegasi and 2^0 east of Regulus instead of Puṣya and Śṛāvaṇa. Balarāma's profile in the epic as

husband of Revatī, has an astronomical reflection in Pegasus – shaped like Plough –that held the winter solstice. If we follow Kṛṣṇa, the war must begin on an amāvāsya presided over by Indra's deity (Śakra-devatāṃ) – and this is not possible if we take it as an amāvāsya on Antares of Indra because winter solstice – 68 days has to coincide with an amāvāsya: As the solstice is sidereally at $307^{0}19'$, going back by 68 days means sun at 239^{0}, close to Mūla who is not related to Sakra in any way. Sengupta circumvented the difficulty by ignoring what Kṛṣṇa has said to Karṇa – and considered the war from the 13th tithi in which Moon was over Kṛttikās and thus he included 81 days between the new moon and solstice. Issue can be resolved only if the amāvāsya is close to Abhijit, which in turn will demand an eastward shift of the solstice by another 21^{0}. That is, for the original epoch of Mahābhārata we need to trace back another 1500 years or so and this will take us to a period around 4000 BC. The interpretation that the day of Śakra devata means the naksatra of Antares can be accepted only if the amāvāsya match the given war calendar satisfactorily without adhoc assumptions like the one made by Sengupta. There are innumerable new moons taking place near Antares but none of them can satisfy the precessional code encrypted in the war diary viz., that the winter solstice took place 68 days after the war beginning on new moon.

To put the matter in brief, the interpolations of Mahābhārata are based on astronomical phenomena and as such the epochs at which interpolations have taken place can be deciphered astronomically by appropriate interpretation of the relevant verses.

11. Epoch of Viśvāmitra and Śakuntaḷa

Importance that the epic gives to Puṣya cannot be overlooked by anyone:

(a) Draupadi's svayaṃvaraṃ (marriage) was in the month of Pauṣa and Rohiṇī nakṣatra

(b) Paṇḍavas and Ṛṣi Dhaumya left their forest station on pilgrimage in the beginning of Pauṣa[11]

(c) The popular definition of Kṛtayuga as being told by Mārkkaṇḍeyā to Pāṇḍavas (III.188.87-88), stipulates the conjunction of Sun, Moon and Jupiter on Puṣya

(d) Drupada asks his priest to proceed on Puṣya yoga (V.6.17)

(e) Duryōdhana ask his Generals to proceed on Puṣya (V.148.3)

(f) Vyāsa has spoken of a comet over Puṣya (VI.3.10 – 17)

(g) Balarāma sets off on Puṣya (IX.33.5)

(h) Kṛṣṇa asks Pāṇḍavas to accompany him on Puṣya to Kurukṣetra (IX.34.39)

(i) Vyāsa says: When Tiṣya arrives in Kali Dharma will become one-footed (XII.327.76)

[11] The verse quoted is confusing: Dhaumyena sahitā vīrāstathānyairvanavāsibhiḥ I
Mārgaśīrṣyāmatītāyāṃ pusyena prayayustataḥ II
'Puṣyeṇa' cannot be correct. It is 'pauṣeṇa' meaning they left in the month Pauṣa that comes after Mārgaśīrṣa.

Puṣya's this *importance* is obviously due to the location of summer solstice in the nakṣatra division. Similarly the other solstice was also significant as may be noted from the verse of Śakuntaḷa:

Ati nakṣatravaṃśāṃśca kruddho nakṣatrasampadā I
Pṛati Śṛāvaṇapūrvāṇl nakṣatrāṇi sasarja yaḥ II [I.65.34]

Śakuntaḷā quoting Menakā about Viśvāmitra: "(Viśvāmitra), anguished by the nakṣatra series chose to create an alternate series beginning with Śṛāvaṇa".

As is the case with many Bhārata episodes, the story of Śakuntaḷā too is an astronomical allegory. Name Śakuntaḷā means one who was fed by the honeybees and on the sky we can find the beehive near which Viśvāmitra and Menakā had forsaken her. It is the star cluster called Praesepe that was close to the summer solstice of 964 BC. Solsticial colure passed through this cluster known as M44 (sidereal λ = 102°40') in 684 BC. In 683 BC new moon coincided with summer solstice and this phenomenon might have inspired some poet to consider the luminaries as Viśvāmitra and Menakā and the solstice over the beehive as Śakuntaḷa. Indra of the story is solstice; as the luminaries continue their motion the story depicted the solstice as a forsaken child. According to Monier Williams Viśvāmitra has got a son too by name Śakunt.

In the period that followed the solsticial colure had been approaching Śṛāvaṇādi and hence the need might have been felt for a calendar reform – which resulted in a calendar beginning with Śṛāvaṇa nakṣatra. Viśvāmitra too is a solar myth as portrayed in the epic and Purāṇas.

12. 14 Years of Rāma's Exile 964 BC – 950 BC

As we have already seen in a previous section Rāmāyaṇa too had its redaction in 964 BC and around as is evident from the importance attached to Puṣya, which represented the solsticial colure passing through Puṣya and Śrāvaṇa. According to the Rāmāyaṇa account, his exile began on Puṣya and after 14 years he returned and was crowned on the same nakṣtra Puṣya and Vaiśākha Saptami tithi. Cardinal phenomena that guided the formulation of the allegory are:

Vernal equinox: Tuesday, 30th March 0840 UT: JD [TDT] = 1369411.1639. Sun = 0°, Moon = 109°54'.

Summer solstice: Friday, 2nd July 1440 UT: JD [TDT] = 1369505.41385: Sun = 90°, Moon (λ) = 277°29' (Siderealy at 294°01'). In the night Moon could be seen near Pegāsus (Aśvapati of Kekaya) and hence the Moon was portrayed as 'Bharata – son of Aśvapati's daughter – born in Puṣya nakṣatra'.

It is apparent from the above that the summer solstice had met the calendar requirement as it coincided with Kṛṣṇa (1) and thus the former year beginning was rejected and this reform was portrayed as the exile of Rāma who represented the spring equinox. The sidereal year beginning of this year was on 14th March 964 BC (0740 UT) with Moon on Śṛāvaṇa nakṣatra (λ =265°34', which sidereally becomes 282°06'. Considering an error of

one day in determining the tithi vis-à-vis the sidereal year beginning it may be presumed that the sidereal year beginning was on Kṛṣṇāṣṭami and Śṛāvaṇa nakṣatra. Giving cognizance to the fact that the characters representing the sidereal calendar were described by the title 'Nirṛta' and the cryptic in which astronomy has been included we may interpret the name Rāvaṇa as a cryptic adaptation of the term "Ś - rāvaṇa" by deleting the 'S'. Also this is the Śṛāvaṇa that appear in the story as Ṛṣikumāra killed by Daśaratha.

After 14 years sidereal year beginning was on Tuesday 13th March 950 BC (2109 UT), Sun λ = 343^{0}39' (=360^0) and Moon λ = 301^{0}45' (318^{0}06') i.e on Śatatāraka (near Pegasus). Tithi was Kṛṣṇa dvādaśi. A new Moon occurred on Friday March 16 950 BC, 20:22 UT at λ = 346^{0}32'(sidereally = 02^{0}53'). According to Rāmāyaṇa, Rāma killed Rāvaṇa or Śṛāvaṇādi calendar was replaced by one beginning with Aśvinis on the Cāitra Kṛṣṇa Caturdaśi and Rāvaṇas funeral took place on the new moon day. Agniparīkṣā took place on Vaiśākha Śukḷa (3) – on 19th March when Moon passed over Kṛttikās (Agni). Vaiśākha saptami was on 23 rd March, having Moon λ = 80^{0}13' (sidereally at 96^{0}45', on Puṣya) for 1200 UT.

Vernal equinox: Friday 30th March 950 BC, 1809 UT: JD [TDT] =1374524.5555. Moon λ = 167^{0}14', sidereally = 183^{0}35' (near Citrā). Tithi was 14.9.

Summer solstice: 3rd July 950 BC, 0:0UT: 1374618.79932; Moon = 330^{0}52' and tithi =21 and sidereally 347^{0}13' (near Pegāsus and Revatī).

Vernal equinox coinciding with full Moon on Citrā (furrow) offered an ideal year beginning for a tropical solar or lunar calendar and this occasion was portrayed as the return of Rāma after regaining Sītā (furrow or Citrā).

13. Alternate Mythological Interpretations of the Course of Rāma

I have already referred to the name of PG Krishnan Nair in some earlier sections. Mr. Nair has published a number of articles in vernacular Malayalam in which astronomical identity of many of the characters are available. Despite some inconsistencies and the description of the astronomical phenomena devoid of a precise epoch its contents offer a lot of food for thought. Relying on his account and the epochal identity given above the following speculations can be made:

→ Ayōdhyā – Middle of Aries: Middle of spring season: Pṛthvi is the location of Vasantha & Śarad and they represent the Kingdoms/ populace as per Niruktaṃ

→ Grīṣma and Hemantha represent atmosphere and forests, nature in its fury. Rāma leaves Ayōdhay for forest as Sun advances to the Grīṣmaṃ that begins at the middle of Vṛṣbha or over Rōhiṇī.

→ New moon happens on Kṛttikā and the Kṛṣṇpakṣa probably got personified as Tamasā river and in the same 'night' or dark half Sun reaches the Gaṅgā.

→ Between Rōhiṇī [Aldebaran] and Citraratha [Capella] Sun finds the Gaṅgā after which the forests begin. Guha, the Niṣāda King of Śṛṅgaverapura who takes Sun across the Ganges 'next morning' or bright half [14^0 transit of Sun] in his boat is Alcyone [Kārttika] as is evident from the appellation Guha of Lord Kārttikeya.

→ After crossing the Gaṅgā, Rāma enters the forest and finds smoke – flag of Agni – an allegorical reference to Elnath [β- Tauri: $57^0$59'] and then reaches the hermitage of Bharadvāja in Prayāga, between the Gaṅgā and Yamunā. Bharadvāja's Āśrama is probably the Punarvasu ruled by Jupiter.

→ Yamuna may be ecliptic or the sign Cancer that has another branch of the galaxy and there another boat is used and as suggested by Bharadvāja Rāma walks further south to reach Citrakūṭ where Vālmīki has got his Āśraṃ. The terms Citrakūṭ and Vālmīki are quite significant – Citrakūṭ may mean a serpent house or literally 'star puzzle' and Vālmīki as explained earlier means the Āśleṣā nakṣatra. From the eulogy made of the place in the Rāmāyaṇa, it is evident that it was the location of summer solstice. For solstice Sun was in rapt conjunction with Jupiter and perhaps this conjunction was interpreted as a meeting with Bharadvāja and his guidance to move towards Citrakūṭaṃ - the precise location of solstice. The maximum declination at the solstices has given the description of a mountain peak [Meru] for the location of solstices.

→ As explained earlier, solstice was sidereally at $106^0$32' - almost midway between δ-Cancri [Puṣya: $104^0$08'] and α-Cancri [Āśleṣā: $109^0$03'].

• Rāmāyaṇa apparently depicts a mix-up of the description of the solar course from vernal equinox to autumnal equinox and the heliacal phenomena at equinoxes and the solstices. Heliacal phenomena at the vernal equinox got described as the palace intrigues at Ayōdhyā with the major characters:

→ Square of Pegasus: Aśvapati, King of Kekaya country
→ Andromeda: Kaikeyī, daughter of Aśvapati and mother of Bharata [Perseus]
→ Perseus rising heliacally after the great square and Andromeda became Bharata
→ Cygnus, high up in the sky became the hunch-backed Manthara

→ As sun advanced further, the constellations Ursae Major [Seven Sages] and Canis Minor and Canis Major heliacally rose followed by Agastya [Canopus] for southern latitudes. These constellations find mention in the story respectively as Atri [one of the seven sages], Sutīṣṇā [Procyon,] Virādha [a monster holding different creatures: Sirius surrounded by many animal figures like monocerotis, Lepus, Puppis etc.], and Agastya. Agastya guides him to Pañcavaṭi, where Rāma meets with Śūrpanakha and Khara [Ass], which are the Monocerotis and the γ & δ Cancri known as Asses.

→ Rāma saw Agastya from the Āśrama of Sutīṣṇa [Procyon] – this is impossible if it meant the longitudinal transit of sun over Procyon. In fact Agastya becomes visible only after Procyon gains considerable altitude for New Delhi. According to Agastya, Pañcavaṭi was in the north, beyond the trees of ambrosia in Gemini and Lynx when viewed from the southern location of Canopus - the direction opposite to the one Rāma had traveled to

reach Citrakūṭaṃ. This change of direction in the course of Rāma is evidently due to the description of the heliacal phenomena of the period after summer solstice.

→ Pañcavaṭi, is the constellation Aurigae made up of five stars on the side of the galaxy which appear here as Godāvari and the principal star α-Aurigae approaching its upper transit around the time of sunrise – after a month from the solstice for New Delhi. Same constellation also appears as the Puṣpaka flying chariot of Rāvaṇa in which he took away Sīta.

→ Towards north of Pañcavaṭi Rāma could see Pṛśravaṇa mountain – author may be referring to the winter solstice located in that direction from where the Uttarāyana had the beginning – and Agastya was in the southerly direction. Incidents at Pañcavaṭi took place between Aurigae and Canopus where we can find the Mārīca [Mṛga in Orion], Jaṭāyu [Monocerotis], and Sirius, Leporis and Columbae constituting the other creatures that confronted Rāma.

→ *Moving further, Rāma meets Śabari, Vindemiatrix [drākṣa-kanyā] at the beginning of* Virgo.

→ Rāma's course over the ecliptic is described in terms of Mātaṅgaśrama and Kiṣkindha, which form the northern precincts of Leo while Ṛṣyamūkācalaṃ where Sugrīva takes refuge is Ursae Major, the Saptarṣis. Coma Bernices could be imagined as elephant leading to the name Mātaṅgavana for the area and the monkeys may be located in Urase Major. Bāli can be identified as the full Moon of autumnal equinox that set eclipsed. Or may be some other object over the ecliptic like Saturn who was near Citrā [Spica]. There is confusion in the profile given that makes a unique identification impossible. Sugrīva is mentioned as son of Sūrya and Bāli son of Indra but these descriptions make no sense in the signs Virgo and Libra. May be they respectively represented the solar and lunar months vis-à-vis calendar and the lunar calendar was abandoned in favor of a solar one after the autumnal equinox that nearly coincided with full moon on Aśvini.

• The 'ayana' described should have ended with the autumnal equinox as the six months are over. But the story – may be because modifications over a long course of antiquity – is devoid of such a precise astronomical time frame. So it is recorded in the Rāmāyaṇa that Bāli was killed before the month of Śrāvaṇa and the monkeys will set off in search of Sīta after the rains with the advent of Kārttika. In fact a sojourn over Kārttika cannot be avoided as the seat of Nirṛta Rāvaṇa is at the junction of Scorpio and Sagittarius, i.e., solar months of Kārttika and Mṛgaśīrṣa. But Nirṛta Rāvaṇa had sway over the Laṅka on equator only in 4137 BC when the equator passed over Mūla. This in fact suggests that the source of the story is not exclusively the epoch of 964 BC, it is related to the original epoch of sidereal zodiac by some astronomical tradition. The shift of the autumnal equinox to Āśvina pourṇāmi was not properly incorporated in the story. [Āśvina pourṇāmi was three days before the autumnal equinox and so the moon was in Taurus for the moment of equinox. Bharata considered as Moon was obviously in Nandi-grāma [Nandi ≡Bull], waiting for the epoch of Rāma to turn up].

• Or, may be that the story incorporates the phenomena over the whole of zodiac – not precisely of any half year. Even though Rāma's horoscope and the allegory of palace intrigues had their origin in 964BC, the description of solstice that we find in the epoch stretches over a long period of time prior to that. This is evident from the story line that Rāma begins the final journey to south in Śrāvaṇa śukḷapakṣa[12] beginning with Uttaraphālguni nakṣatra, as the days gradually became shorter and reaches Māhendra Mountain [allegorical reference to summer solstice] in due course. This is possible only around 4000 BC. A supporting fact is that it is after Rāma's arrival at Māhendra that Rāvaṇa orders for the waking up of Kuṃbhakarṇa, which must coincide with the beginning of Dakṣiṇāyana[13], day of the demons.

→ Rāma's victory over Rāvaṇa is depicted as on Āśvina Kṛṣṇa [10] or Vijayadaśami – this is an impossibility when the monkeys had set off in search of Sīta in the month of Kārttika. This mix up is due to the reasons I have already mentioned – shift of autumnal equinox over Rāvaṇa's Laṅka from the end of solar Kārttika in 4000 BC to the middle of solar Āśvina in 1000 BC.

→ Sīta is the personification of Ākāśagaṅgā. As sun leaves Aurigae [Pañcavaṭi] he is able to meet her only after crossing Mūla, which is at the galactic center. This is the reason for the legend that Sīta was the daughter of Rāvaṇa, born in Laṅkāpuri and abandoned on the advice of Brahmarṣi Nārada.

→ Author of the story is Vālmīki – solstice transiting over Āśḷeṣa. The twin sons of Sīta who is brought up in his Āśṛama are the stars Castor and Pollux, the stars that heliacally rise at the summer solstice. Cardinal points constituted the four sons of Daśaratha – Lakṣmaṇa: summer solstice and Bharata that of winter.

14. Location of the purāṇic Cities

There have been many efforts to locate and excavate the ancient Indian cities mentioned in the Purāṇas. A recent report spoke of unsuccessful excavations at Citrakūṭaṃ, failure to locate ancient ruins was explained as due to palaeo-climatic changes caused by the Ganges. Nothing can be more far from the truth. Citrakūṭaṃ[14] of epic fame was in the sky and the terrestrial Citrakūṭaṃ is only a later development – the present Citrakūṭaṃ received its name only when the epic story became popular. Similar is the case with Hastināpura – capital of the lunar race – and Ayōdhyā – capital of solar race. Hastināpura, the city of the Great Archer Bhīṣma, was situated on the side of the Ākāśa Gaṅga instead of the terrestrial Ganges and is therefore forms a part of the sign Dhanu or Sagittarius. A malayālaṃ book on stellar myths suggests it to be the asterism Uttarāṣāḍha. The small town situated about fifty-seven miles northeast of modern Delhi (according to Monier Williams) on the banks of an old channel of Ganges had no role to play in the epic drama. Obviously excavations at this place also proved to be a failure.

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[12] This must be of the Pūrṇimāntha system and may be Adhimāsa.

[13] This is a wrong identification that was prevalent since ancient times. Actual Dakṣiṇāyana that is the day of the demons is from autumnal equinox to vernal equinox, when the sun is in the south of equator.

[14] Citrakūṭaṃ means the 'Stellar puzzle' – it was the position of the summer solstice in 964 BC.

Ayōdhyā, the palace of Sun or the place where Sun reigns is earth (made of iron and hence the name Ayōdhyā) and on the earth his palace is at the point where the solsticial colure cuts the ecliptic – the summer solstice that gives him maximum north declination. It was here the solar princes were born in Puṇarvasu, Puṣya and Āśḷeṣā nakṣatra – the place is none other than the sign of Cancer in the period since 1900 BC to AD 231. Laṅka was on the equator – obviously either of the equinoxes and the Laṅka of Nirṛta Rāvaṇa is the location of Mūla. Similarly Ujjain is the place where the Uttarāyana begins and hence the present place was named so as the sun attains maximum declination at Ujjain on the tropic of Capricorn.

Sītā born of the furrows is the Citrā star / Moon/ some calendar phenomenon and Mithila of Rāmāyaṇa is the Kanyā rāśi with Janaka as the Sun. Godāvari of the Rāmāyaṇa can be identified as the river in which Śabari had taken her bath to relieve it of Rāma's curse – Śabari is Vindemiatrix or ε - Virginis, ['Drākṣakanyā' according to Karaṇdikar] located at the beginning of Virgo. The original Śabari hills too has to be there rather than in Kerala. On the other hand if we accept that these are references to terrestrial stations then see where lies Godāvari and where Śabari Hills – was it possible in ancient times for Śabari to move from Kerala to take bath in Godāvari to relieve her of Rāma's curse? Kaikeyī of the Rāmāyaṇa as mentioned earlier is the Andromedae and Kekaya, Mīna rāśi. The Great Square of Pegasus to which she lends her α - star may be the chariot of Dāśaratha – Sun of winter solstice.

The profile of Jarāsandha that we meet in the epic and the story of a 15 – day war is unbelievable as a terrestrial happening. On the contrary it makes sense as an astronomical allegory involving full moon of Kārttikā – Jarāsandha was the equinox characterized by the full moon of Kārttikā that lost relevance with the passage of time due to precession. Vāyuputra Bhīma who contested him is the Svāti nakṣatra, which had come to possess the autumnal equinox. At a later epoch Svāti got portrayed as Hanuman. Jarāsandha's legendary birth in two parts (as divided) is an allegorical description of the name Kṛttikā and allows us to identify him and to find the location of Magadha in the sky – the Kṛttikā nakṣatra.

Some of these interpretations may appear far fetched and it is only quite natural as allegorical descriptions of astronomical phenomena arise out of far fetched imagination if not wild. Deciphering the substratum of astronomy too therefore involves an exercise of stretching one's imagination and conjectures.

15. Short Notes on Controversies

a. A Note on the 'Greek Origin' Theory

The theory of Greco - Babylonian origin of Hindu astronomy originally developed by Whitney, Thibaut and others was given a fresh impetus in recent times by David

Pingree.[15] Present author is indebted to Sri. B. N. Narahari Achar for providing with the copies of a few papers bearing on the subject. Pingree's important conclusions are available in:

1. 'The Mesopotamian Origin of Early Indian Mathematical Astronomy', Journal for the History of Astronomy, iv (1973), 1-12
2. 'The Recovery of Early Greek Astronomy from India', JHA, vii (1976), 109 – 123

These papers profess respectively:

• **Dependence of Vedāṅga Jyotiṣa on the Mesopotamian science of the Achaemenid[16] period**

→ Overwhelming evidence is available for the Mesopotamian inheritance [During 513-326BC] of some elements of early Indian astronomy while for the hypothetical reconstruction the evidence is only persuasive and as per the 'cautionary note' added, he has failed in his attempt to hypothetically reconstruct the development of the Indian intercalation-cycle.

→ What he calls as evidences are the use of water clock, linaer zig-zag functions, ratio of longest to shortest daylight, gnomon etc., of which direct or indirect references are available in Ṛkjyotiṣa.

Pingree has professed a Babylonian indebtedness for these references on the basis of the references to water clock in *mul Apin* and similar Babylonian texts compiled around 700 BC. To avoid a counter thesis of Indian orgin inspired by the same factors as above, Pingree has convenientlky sidelined the most important chronological feature provided by Ṛkjyotiṣa, the line of solstices across the Delphinis and the middle of Āśleṣā that gave a minimum antiquity of 1180 BC to the treatise even by the most conservative estimate. To sabotage the antiquity that the text evidenced, Pingree has proposed an error of 10 days in the determination of the winter solstice and some other fictitious arguments that amply reflects the bias of his mind and despicacble intentions of his study. Further, we must note that he could not 'hypothetically reconstruct' (in his style) or concoct a theory that explains the Indian intercalation-cycle. Despite all the ingenuity he has displayed in professing a Babylonian connection none will subscribe to his argument concocted exclusively to play down the real chronological indicator of the Jyotiṣavedāṅga for bringing down its antiquity to fifth century BC.

In the light of Holay's true interpretation that the epoch of Ṛk-recension corresponded to the coincidence of winter solstice with the full moon on Maghā, which we have already dated and other references to the line of solstices in the Vedic and Purāṇic literature no elaboration is attempted of the fallacy of Pingree's hypothesis.

[15] Department of Mathematics, Harvard University

[16] Achaemenid period: The few centuries that followed the conquest ['shortly before 513 BC'] of Indus Valley by Darius the Great

• Non-Ptolemaic Greek Astronomy in India

He begins his thesis by stating:"The transmission was certainly very complex. It involved many levels and periods of Greek astronomy: adaptations of Babylonian lunar and planetary theories; the year length of Hipparchus, an adaptation of his co-ordinate system for fixed stars, and his theories of precession and trepidation.... And this transmission extended over several centuries; it apparently began in the second century of our era and continued till the late fourth or early fifth century. The locations of the recipient Indians indicate Western India as the point of entry of these various Greek theories; there exists literary, epigraphic, archaeological and numismatic evidence for a massive Greek influence on this area in precisely the period of this transmission".

→ Interestingly according to his on admission none of the original translations of Greek texts into Sanskrit has survived and often sufficient evidence is not available to be very confident about particular details in the historical process that led to the creation of the astronomy of the Siddhāntas.

→ After outlining the Indian techniques which are traceable to Greek papyri and other texts, Pingree has added the comments:

"These techniques as preserved in the Sanskrit texts were certainly not invented in India, which lacked the astronomical tradition neceassary for the development. Nor were they introduced directly from Mesopotamia since they first appear, in a crude form, in the Yavanajātaka, which is based on the translation of a Greek text made three-quarters of a century after the last dated cuneiform ephemerides was inscribed. The full forms of these techniques are found in India only in texts, the Vasiṣṭha and the Pauliśa, of the third or fourth century which represent translations of Greek texts other than that translated by Yavaneśvara. The papyri, Geminus, Vettius Valens and the three Sanskrit texts all attest to the popularity of this Greco-Babylonian astronomy in the Roman Empire in the first three or four centuries of our era".

Each and every sentence of this paper is designed to facilitate the conclusion of pre-Ptolemaic Greek sources for the Indian astronomy. One of the most important parameters, the anomalous year length of 365.25875 days is described as of Greek origin despite being well-known that it is a Babylonian value. Same can be said about the Julian year also. Present author is not inclined to dispute that the Siddhāntic astronomy contains ideas borrowed from Greeks such as epicycle model, trepidation theory etc. But the arguments adduced to favor such a conclusion – that India had no astronomical tradition or that Vasiṣṭha and Pauliśa Siddhāntas are translations of Greek works etc., are all concoctions aimed to favor a Greek origin. Pingree has tried painstakingly to reconstruct Āryabhaṭa's method of derivation of the integral number of planetary revolutions, but such a clumsy procedure based on Greek mean motions was not at all required as the present author has shown in a paper published in the IJHS.[17] The difference in the value of solar year employed alone can attest the indigenous astronomical tradition of the Hindus, quite distinct from that of Hipparchus and those who followed him. Prevalence of the anomalistic solar year in Greek records on the contrary

[17] Chandra Hari, K., 'On the Origin of Kaliyugādi Synodic Superconjunction'

proves the popularity of Hindu sidereal zodiac among the Greeks around the beginning of our era or even earlier.

b. Purāṇas and Jyotiḥśāstra

Another of Pingree's papers on Hindu astronomy entitled 'The Purāṇas and Jyotiḥśāstra: Astronomy' appeared in the Journal of the American Oriental Society in 1990. The inherent bias of the author is well evident in the assertions he has made in this paper:

1. "Dhruva is also a late concept: it first appears in the prescriptions for the marriage ceremony given in the gṛhyasūtras, though there only as an unmoved star, not as one pole of the axis about which other celestial bodies revolve".
2. On the basis of this reference to Dhruva, the purāṇic cosmology can be dated to 500 BC.
3. As is the case with all his papers bearing on Hindu astronomy, certain contents of the Babylonian tradition and Yavanajāataka are used to allege a Greek origin around 2^{nd} to 5^{th} century AD for certain purāṇic contents.

The fallacy of these statements can be well understood in the light of the information contained in the present work on Indian antiquity. As for example: The Puṣya epoch of the epics as deciphered from both Rāmāyaṇa and Mahābhārata to be 964 BC attest the accuracy of the Hindu astronomers at that time in fixing the solstices and equinoxes. As imagined by Pingree, there cannot be an error of 10 days in the determination of cardinal points or in identifying the boundaries of nakṣatra divisions.

In the preceding sections of this book, we have seen that the Babylonian zodiac itself was based on an Indian rationale and the Siddhāntic epoch of this zodiac was Caitra śukla (1) that coincided with the vernal equinox of AD 231 when the sidereal and tropical zodiacs coincided. The year length of the pre-Varāhamihira or pre-Āryabhaṭan astronomy or that of the original Pauliśa that incorporated the $\mathbf{K}_0$ assumption, as was noted by SB Dikshit would have been different from the value of 365.25875 days. The epoch of AD 231in fact demanded the year to be anomalistic, the value of which too can be found in the cuneiform tablets. What is apparent in these coincidences are certainly not a Greek origin and on the contrary the situation makes a differentiation as Babylonian or Indian very difficult for the astronomy contained in cuneiform tablets. Further, the ancient seat of Indian astronomy and sidereal zodiac was probably Kerala (instead of Western India) where we meet more with Babylonian contacts rather than Greek ones. In fact, there is nothing that can be termed as "Greek original" and everything is Greco–Babylonian, a phrase under use by Pingree to describe the adaptation of Babylonian concepts and methods by the Greeks. On the contrary the sidereal zodiac and time units such as tithi are original Indian concepts that were taken to Middle East by migrating communities. The development of these concepts might have taken place in Harappā and Mohenjodaro where a Tāntric civilization flourished before [perhaps geological cataclysms that led to] the drying up of Sarasvati.

c. Tradition and Rationale of Phallus Worship

The antiquity and rationale of the sidereal zodiac finds an indirect illustration in the speculations that have made of the phallic tradition by anthropologists. We have already seen that the ancient custom had its origin from the prehistoric Tāntric astronomy in which phallus symbolized the fiduciary star Mūla and hence the Wheel of Time or Kālacakra. Also we have shown that the association of the Phallus or Mahākāla with Nāga or serpent follows from the prehistoric conception of sidereal zodiac as Rāhu-Śikhi Cakra [Kālasarpa] – based on the Nodes of moon's orbit which in mythology had the appellation Serpent. Loss of these true rationales of the Phāllus and Nāgapūja has led the scholars to wild speculations about the origin and meaning of these customs. An account of these speculations, available in Chapter III of the work *The Concept of Rudra-Śiva through the Ages* by Mahādev Chakravarti, provides ample illustration of the dangers inherent in building speculative theories to bridge the gap of our ignorance. Speculations in fact reflected the mindset of the scholars and unknowingly everyone tried to impose their ideas on the origin and meaning of these customs. Scholars have looked upon Phallus worship as 'a primitive custom related to the veneration of the organs that facilitated procreation', 'degradation of a universal primitive belief in a Great Father God and Mother Goddess', 'metamorphosis of agricultural deities' etc. Few very interesting remarks are:

• "The placing of the Ganges on his head in the post Vedic period was to emphasize his fertilizing power. The moon on the forehead of the deity is also a 'source of moisture and fertility..."

See the difference between the true picture of Śiva and the speculations. The Ganges on Śiva's head is the Ākāśa Gaṅgā that cuts the ecliptic at the point where Mūla is located and the iconography of Śiva had its origin from his representation of the phenomenon of Time rather than agriculture. Iconography of Śiva and Phallus worship had their origin from astronomy and the science of Yoga as we have already established.

• "The fish as a phallic symbol was common to many races of antiquity. Freud finds in fish a symbol of the male organ; but it – especially its head and mouth – has also been recognized as a female symbol. Statues of the goddess Isis often show her with a fish on her head. Dragon, the god of the Philistines mentioned in the Old Testament, was half-man and half-fish resembling somewhat the matsyakanyā of Indian folklore..."

Scholars have given no cognizance to the astronomical aspects of the symbol of fish (and of course the kanyā too) in their biased resolve to explain the custom using what they considered as primitive notions.

• "*Fire-drills have received phallic interpretation. The mode of producing fire by wooden apparatus in the ancient world by rapidly rotating a piece of upright hardwood upon a softer wood lying on the ground is so suggestive that the upper and lower sticks, resembling male and female, have received sexual interpretation. Thus wooden apparatus is called araṇi in India. It is interesting to note that even in the Ṛgveda the rubbing of the two fire sticks is represented as an act of generation because it resembles*

the phallus in the yoni. The upper wood made of Aśvattha and the lower made of śami are distinguished in the Atharvaveda, Śatapatha Brāhmaṇa, Taittirīya Brāhmaṇa and Kātyāyana Śrautasūtra. In the Śatapatha Brāhmaṇa, the two sticks have been compared with Purūravas and Urvaśī. In the Bṛhadāraṇyaka Upaniṣad a great similarity is drawn between araṇī and human procreation. All the above details prove that the idea of procreation also affected or contaminated the thought of the Vedic Aryans, though they hated phallus worship. Definitely it does not prove that the origin of the liṅga is to be found in the araṅi for the phallus-worship was already very popular with the people of the Harappan civilization, which antedates the Vedic".

We have already referred to the similarity between the sexual act and the generation of fire using araṇi. Similar is the processes of churning the Milky Way as described in the Purāṇas, the phenomenon of diurnal rotation and the precession of the equinoxes. The similarity of these processes arise out of the zodiacal symbolism vis-à-vis the anthropomorphism of calendar phenomena and in fact contributed to the great confusion that prevails with the Vedic literature in comprehending the terms such as Agni. Earth, the axis of rotation/pole star and the heavenly canopy facilitated the birth of a new year in the same way Agni was born of the araṇi and thus the year beginning/cardinal points received the appellation Agni in Vedic literature. It is important to note here that the Mārgaśīrṣādi sidereal solar year had its beginning at the junction of Mūla that marked the genitals and thus the beginning of the New Year completely matched the symbolism of sexual act or the generation of fire from Araṇi. Mūla, marked the galactic center and the genitals of Kāla or time personified/seat of Kuṇḍalinī or Kulakuṇḍaṃ and hence adequately represented the Araṇi.

Harappā Connection

As evidenced by the ruins of Indus Valley, Śivaliṅga stands forth as the symbol of their prime deity. On the contrary certain Ṛgvedic verses are suggestive of an aversion to such worship of the phallus. The intricacy noted by Marshall -(as indicated by Mahadev Chakravarti (p.126): 'Marshall is at a loss to explain how, having once worshipped Śiva and the liṅga as in the Harappā civilization, the people ceased to do so in the Vedic period, but returned to the worship later' – can be explained only by hypothesizing the co-existence of the Tāntric and Vedic tradition in Indus – Sarasvati Valley. Both these traditions had as common factor Yoga while the totality of esoteric wisdom comprising of the triplet of sciences, Yoga, Jyotiṣa and Āgama probably rested with the Tāntrics till Vedavyāsa Kṛṣṇadvaipāyana hijacked the Tantra and Śiva through the great epic and the Gītā.

d. Evidence of the Aruṇopaniṣad[18]

Evidence in favor of the above conclusion follows from Aruṇopaniṣad which may be considered as a tāntric interpretation of the 32 Anuvākas beginning with "Bhadraṃ karṇebhiḥ..." and ending at "Tapasvī puṇyo bhavati" constituting the 1st Prapāṭhaka of Taittirīya Āraṇyaka. Lakṣmīdhara, one of the commentators has added a tāntric introduction to the Āraṇyaka verses from Rudrayamala-tantra which is:

[18] Sundaramoorthy, G., Aruṇōpaniṣat, Śrīvidyā Educational Society, Madurai

Pṛśnayō nāma munauaḥ sarve cakrasamāsrayaḥ I
Sevamānāścakravidyāṃ devagandharvapūjitāṃ II 1 II

Pṛśṇis, sages who are adept in 'Cakravidya' have resorted to the worship of Śṛīcakra, which is worshipped even by the Devas and Gandharvas.

Agnīṣōmātmakoṃ cakramagnīṣomamayaṃ jagat I
Agnāvantharbabhou bhānuḥ agnīṣōmamayaṃ smṛtaṃ II 2 II

Both the Cakra and the Universe are constituted by the Agni and Sōma. Sun is inherent in Agni and hence the constituents have been listed as Agni and Sōma excluding Sun.

Trikhaṇḍaṃ mātṛkācakraṃ sōmasūryānalātmakaṃ I
Tṛkoṇaṃ bindavaṃ saumyaṣṭakōṇāṃ ca misrakaṃ II 3 II

Mātṛkācakra (Śṛīcakra) has three components arising from Sōma, Sūrya and Agni. The Bindu and the enclosing triangle are of Sōma while the eight other triangles belong to all.

Cakraṃ candramayaṃ caiva daśāradvitayaṃ tathaiva I
Caturdaśāraṃ vahnyestu catuścakraṃ ca bhānumat II 4 II

The wheel of twelve spokes is of Moon and of fourteen of Agni while the wheel of four spokes belongs to Sun.

Etatprasādādindrādyā vasavō*f*ṣṭou marudgaṇāḥ I
Ye ye samṛddhā lōke*f*smin tripurācakrasevakāḥ II 5 II

Indra and other gods, eight Vasus and Maruts, all have attained prosperity by the grace of Śṛīcakra. Same is true about all those who are prosperous.

Puratrayaṃ ca cakrasya somasūryānalātmakaṃ I
Mahālakṣmyāḥ puraṃ cakraṃ tatraivāste sadāśivaḥ II 6 II

Śṛīcakra, the abode of Mahālakṣmī has the three abodes of Moon, Sun and Agni as well and the Sadāśiva too dwells there.

Commentary of the Aruṇōpaniṣad begins after this introduction with the Āraṇyaka verse 'Imā nukaṃ bhuvanā sīṣadhema', and the word Imāṃ is taken as referring to the Śṛīcakra. A true elucidation of the succeeding verses is possible only in Tantra and this is possible only because of the fact that the Taittirīya Āraṇyaka is originally a tāntric composition rather than the kind generally referred to as Vedic. In these verses we can also find the words like 'Bhārataḥ', 'Ayōdhyā', 'Deva', 'Asura' etc with unconventional meanings. It is evident therefore that the authors of the epics and Purāṇas have ingeniously drawn their cryptic terminology from the Tantra and Vedic literature. Śṛīcakra in fact is the geometrical abstraction of the esoteric powers inherent in Man and is the basis of the mathematical structure of the zodiac as well as the astrological wisdom. In other words, it is the geometrical abstraction of the esoteric power implicit in both the microcosm and macrocosm. Pṛśnis (word literally means cows), the sages in fact are the

personification of Ādityas who dwell over the Śrīcakra – abstraction of the esoteric power spectrum of the Universe. This is evident from the explanation provided by G.Sundaramoorthy that the Pṛśṇis contemplated on the existential questions that arise in our minds and realized that the worlds are established in their proper places because of their worship and the grace of Śrīvidyā. It is the unified power out of which the whole world seeks its diverse potentials of manifestation and thus the relationship existing between the world and Śrīcakra is same as that between a worshipper and the worshipped.

The symbolism that Śrīcakra has with the phenomenon of time becomes apparent in the description of the 360 rays with which the Goddess envelope the Universe:

Mūlādhāra	Pṛthvī	56
Maṇipūra	Ap (Water)	52
Svādhiṣṭhāna	Agni	62
Anāhata	Vāyu	52
Viśśuddhi	Ākāśa	72
Ājńa	Manas	64
Sahaśṛāraṃ	Grace	2

The general trend is to explain the 360 rays as the 360 days of the Sāvana year. See what Sundaramūrthy says:

"The Śrīvidyā worshipper is prescribed with this type of dhyāna to feel his identity with the 'year' and through the year he identifies himself with the Goddess who is the original producer of these 360 rays"

This interpretation is a case of obliteration of the true tāntric rationale as the tradition has come to confuse between the sidereal zodiac and the seasonal year. The seat of the mystic power is the Mūlādhāra Rāhu-Śikhi Cakra constituted by 360 spokes which represent the sidereal course of the Sun over 365.2563624 days. 360 are therefore 360 sauradina and not sāvana as usually understood. In Upāsana, identification of the microcosm with macrocosm is sought to achieve a resonance between the Mahākuṇḍalinī or Śrīvidyā and the Kumāri at rest in the Mūlādhāraṃ. Year has no role to play here – it's the sidereal zodiac that constitutes the Yantra of mystic powers. Luni-solar phenomena with appropriate intercalation to keep pace with the stellar background [Devagṛhāvai nakṣatrāṇi] is the Time that merits worship and not any arbitrary conception like 360 days or the seasonal phenomena. The true rationale was perhaps lost and replaced by sāvana or seasonal years possible under the influence of the Yajńa oriented Vedic tradition. Astronomy was significant in Tāntric tradition as it enabled the concordance between the Kuṇḍalinīs – the basic requirement of the science of microcosmic and macrocosmic interactions. Phallus symbolically represented this concordance as it enshrined the astronomical and mathematical wisdom that choose Mūla as the fiducial star of the sidereal zodiac [Rāhu –Śikhi Cakraṃ]. Note the importance of Rāhu and Śikhi, the nodes of moon or the points that represent the collinear alignment of Soma and Sūrya vis-à-vis the eclipses.

Against the above background it is apparent that the sidereal zodiac was a pre-requisite for the development of the Tāntric and Vedic tradition. Tāntric interpretation of the Taittirīya Āraṇyaka of Ṛṣi Aruṇaketu calls out for a change in our perceptions on the real nature of the literature that has come to be known as exclusively Vedic. When we think of a date for the Aruṇopaniṣad, the Vedic tradition is of no help and available evidence suggests its first recorded appearance only around 15th century AD. It is quite unlikely that someone could manage a tāntric interpretation of the verses after thousands of years of their origin in the Vedic tradition. In fact some of the verses are available in the Ṛk and Sāma saṃhitās also and this leads to a very complex situation as far as the real purport and the date of the verses are concerned. This complexity may be the result of the extinction of the occult tradition that probably held the true historical/genesis/interpretational details and within the present state of knowledge of Indian antiquity it can be resolved only if we assume that the esoteric literature of the Tantra and Veda had their evolution in the Indus – Sarasvati Valley of Western India.

e. Epic Locales and Archaeological Evidence

This aspect we have already referred to briefly on some previous occasions. Here an elaboration is attempted to supplement the non-specialist reader with the information needed for a better understanding of the intricacy posed by the Indian antiquity. General notions place the beginning of Neolithic cultures in India around 8000 BC in Baluchistan. Beginning of the Harappan phase is ascribed a date of 4000-3500 BC and according to hypothetical reconstructions based on archaeology the civilization had a millennium of development and then it declined and faded away completely by 1000 BC when its last flickers got absorbed by the Painted Grey Ware (PGW) culture followed by Northern Black Polished Ware (NBPW) culture in 700 BC. Excavations at the places bearing the epic names such as Hastinapura, Kurukṣetra, Ayodhya, Śṛṅgaverapura, Citrakūṭa etc have shown that none of these places antedates the PGW culture beginning in 1000 – 900 BC. Archaeological evidence in fact contradicts the purāṇic account as the so-called Indraprastha of Mahābhārata antedates the Ayodhya imagined to be of Rāmāyaṇa. Kochhar[19] has tried to explain the intricacy using the theory of Aryan invasion – based on the hope that the events described in Rāmāyaṇa unfolded in Afghānistan around 1400 BC. He has placed the Laṅka of Rāvaṇa in an Indus island and has interpreted the 'monkeys' as non-Aryans.

However, Kochhar, a reputed astrophysicist, has mentioned many factors that suggest the validity of the astronomical interpretation made of the epics in the present work.

→ Large scale inhabitation east of the Yamuna-Gaṅgā doab did not take place until after 900 BC

→ Geographical description of Rāmāyaṇa is inconsistent with the geography of Gangetic plane.

→ Description of rivers in Rāmāyaṇa is erroneous – eg: the meeting of Gaṅgā and Sarasvati.

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[19] Rajesh Kochhar, The Vedic People, Orient Longman Ltd, Hyderabad

→ There's no mention of Rāma in the Vedas.

→ The tradition of celebrating Rāmanavami and Vijayadaśami are of calendric origin – they fall six months apart and correspond to the spring and autumnal equinoxes. Vijayadaśami as celebrated in the autumn do not match with the war diary of Rāmāyaṇa.

f. Astronomical interpretation of Rāmāyaṇa versus Archaeology

• Absence of material culture at the epic towns before 1000 BC attests the accuracy of the dating of the latest redaction vis-à-vis the naming of new places to BC 964.

• Puṣyaparva events of the Mahābhārata took place in Takṣaśila and the same may be true about the Rāmāyaṇa. According to Kochhar, it was Bharata's son Takṣa (shorted Takṣaka) who founded the city and this is an indirect pointer towards the existence of the city and the genesis of the epics there.

• After the redaction of the epics [BC 964 – 900] migration took place to the present day places such as Ayodhya, Hastinapura, Indraprastha etc and the places were named after the epics.

• Conflict of Vijayadaśami

In the section 'Astronomy of Epics' we have already seen that the story of Rāmāyaṇa has at its basis the allegorical description of the astronomical phenomena of 964 BC. Valmīki's description of Rāma's birth horoscope finds a remarkable agreement with the planetary positions of this epoch which by all assessment lies beyond the recognized ages of Horoscope and zodiacal signs. Further, the reflections of stellar mythology that we see in the episodes of Rāmayaṇa and Mahābhārata testify the prevalence of a prehistoric astronomical tradition in India. Available archaeological evidence suggests the seat of such developments as Harappa and Mohanjodaro where both Tantra and the Sanskrit language coexisted quite contrary to the prevalent notions on both Tantra and Sanskrit. Tāntric terminology lies at the root of our Vedas, Epics and Purāṇas and without giving due cognizance to this fact the ancient literature of India cannot be properly understood.

Rāma-navami is obviously the vernal equinox of BC 964 and it matches both the tradition and the description in Rāmāyaṇa. How come the Vijayadaśami came to be celebrated in the autumn when the war has taken place in Caitra?

This intricacy arose out of the many redactions that Rāmāyaṇa has undergone. The original astronomical kernel underwent dilution at successive redactions centered about the anthropomorphic characters. Just as Rāma's birth represented the spring equinox and sun's crossing of the equator to the north, Rāvaṇa's Laṅka too was on the equator and marked the transit of sun to the south. Original epoch at which the story took shape was 4137 BC when the spring equinox was near Mṛgaśīṣa, personified as Ṛṣyaśṛṅga and autumnal equinox over Mūla, personified as Nirṛta Rāvaṇa. Story got redacted in BC 964 with reference to the cardinal points but with a mix up and neglect of the astronomical

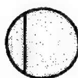
details. Thus the war that was to end with the autumnal equinox as per the tradition of Vijayadaśami ended only in Caitra and the complete course of the sun finds a description instead of one ayana from spring to autumnal equinox. In BC 964 Daśaratha was the summer solstice marked by the heliacal rising of Mṛgaśīrṣa (Ṛṣyaśṛṅga) and white horse used for the Aśvamedha was the constellation Pegasus whose heliacal rising heralded the spring equinox.

Against the above interpretation, places other than Takṣaśila have no epic significance. Astronomy implicit in the story can have its origin only in the Indus Valley civilization which has many features in common with the Mesopotamian culture from where immense astronomical records have been unearthed. This civilization was Tāntric cum Vedic and represents the material culture that gave rise to the Tantras, Vedas, Epics and Purāṇas. Some of the allegorical descriptions such as the confluence of Gaṅga, Yamuna and Sarasvati in fact represent the tāntric confluence of Ida, Piṅgala and Suṣumna and they cannot be located anywhere on the earth unless we find some rivers and name them accordingly. The fact that many Hindus believe in a confluence of Gaṅga, Yamuna and Sarasvati at Prayāg (Allahabad) is a reflection of the idiosyncrasy that the civilization has come to accumulate since the fall of the Indus civilization.

Absolute lack of archaeological records that speak of the dynasty of Rāma in or around Ayodhya or in any other place in the world has led the scholars to underestimate the historic worth of Rāmāyaṇa and thus it stands today as a fictitious story. But the astronomical interpretation imparts a new historical meaning and significance to Rāmāyaṇa and it becomes capable of throwing enough light onto the existence of a scientifically advanced civilization in ancient India.

- **Places of Mahābhārata**

No archaeological records that speak of Kṛṣṇa have become available even though Dvāraka has evidences of a civilization dated to 1500 BC. This is a situation that contradicts the experience with other nations of the world like Egypt where records that speaks of their ancient rulers have been unearthed. Lack of archaeological evidences leaves scope for one and only one conclusion that the epic and most of the Purāṇic kings are mythical in origin and they had their existence over the sky and in the minds of an enlightened community.



Appendix - III

CONCEPTS OF ASTRONOMY

• Celestial Sphere

The imaginary stellar firmament at the center of which an observer finds himself placed is known as the Celestial Sphere. As the astronomical measurements are angles rather than distances this conception is of fundamental importance in positional astronomy. The apparent position of a celestial body is the point at which the line drawn to it from the observer meets the celestial sphere. The radius of the sphere is considered extremely large so that the lines from observers placed anywhere on the Earth to any given star will cut the celestial sphere in the same point.

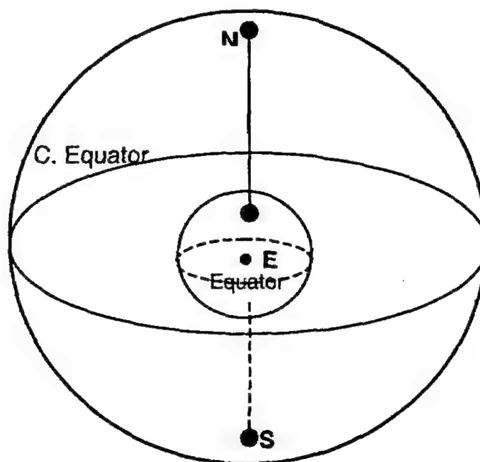


Fig. 1

E – Earth
N – North Celestial Pole
S – South Celestial Pole

• Celestial Poles

Due to the rotation of the earth on its axis from west to east the starry sphere appears to rotate from east to west (diurnal motion) about two points which are the projections of the earth's axis or poles on the celestial sphere.

• Celestial Equator

The projection of the earth's equator on the celestial sphere is known as the celestial equator.

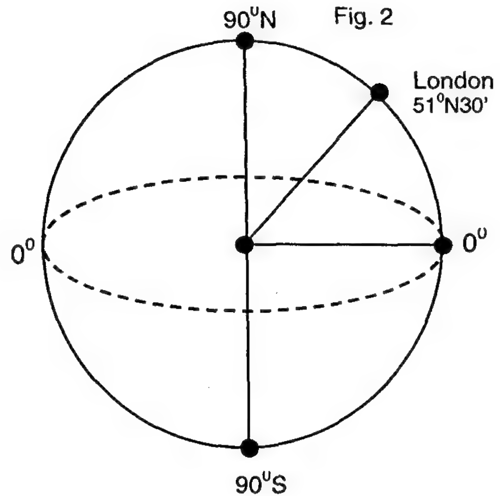
• Zenith – Nadir – Horizon

Zenith is the point vertically overhead on the celestial sphere while Nadir is the diametrically opposite one. The great circle for which the Zenith and Nadir are the two poles is the Horizon.

• Meridian and Prime Vertical

The great circle passing through the zenith and the poles is known as the Meridian. At right angles to the meridian the great circle through the zenith and nadir is the Prime Vertical. While the former meets the horizon in the north and south points the latter cuts on the east and west. Meridian in fact is the hour-circle passing through the zenith and is

therefore perpendicular to the horizon as well as to the equator.



• Latitude and Longitude

The latitude of a location is defined as its angular distance from the equator as measured from the earth along the Meridian. Latitude north of the equator is considered positive and that of south negative. The latitude of the equator is thus 0^0 and that of the North and South Pole are respectively (+) 90^0 and (–) 90^0.

Longitude of a place is the angular distance measured eastwards from the center of the earth along the equator between the meridian passing through Greenwich and the local Meridian.

• Greenwich Meridian

The great circle passing through the North and South Poles and the Royal observatory at Greenwich has been adopted internationally as the standard meridian of 0^0 longitude. The longitude is measured 0^0 to 180^0 either towards the west or towards the east.

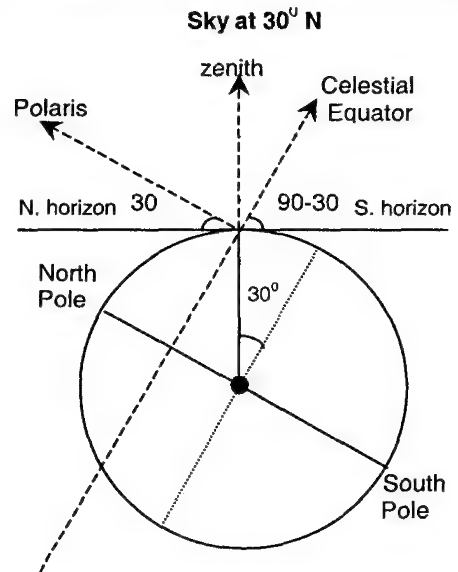


Fig. 3

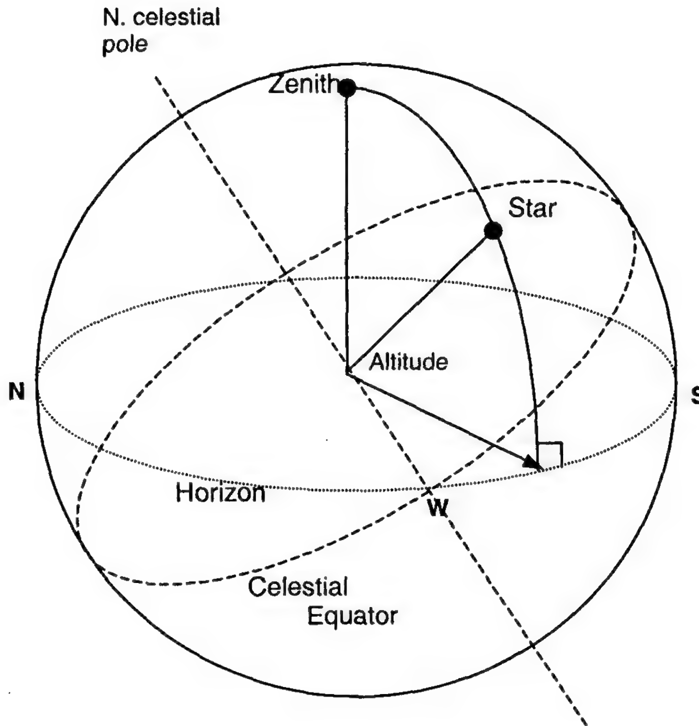
Equator and the Greenwich Meridian, both divide the celestial sphere into two hemispheres north and south as well as east and west respectively. In a similar way horizon divides the celestial sphere into a visible half and invisible half.

• Transit or Culmination

Due to diurnal motion every celestial body crosses the meridian twice in a day at positions called 'Upper Transit' which is near to the zenith and the 'Lower Transit' that is farther from zenith. The interval between two successive transits of the same kind (upper or lower) is known as a sidereal day.

• Celestial Equator and Horizon

The celestial equator is directly overhead only when viewed from the earth's equator. When viewed from the northern hemisphere the celestial equator is inclined at an angle to the horizon and attains its maximum altitude in the south while in the north equator stands depressed and therefore the celestial north pole or polestar will be found at an altitude equal to the latitude of the observer. Figure is illustrative of the sky at 30^0 North latitude.



←Fig. 4 shows the altitude of celestial equator due south and the altitude measurement of a star over the great circle passing through the zenith and nadir and intercepting the horizon at right angle.

• Ecliptic and Equinoctial points

The earth moves through space in an elliptical orbit that is centered on the sun. The earth is also spinning like a gyroscope, keeping its spin axis in a fixed orientation in space through out its annual motion round the sun. As a result sun appears to slowly move against the backdrop of stars round the celestial sphere during the course of a year and this apparent annual path of the sun is called the 'Ecliptic'.

Earth's axis being not perpendicular to the plane of its orbit but inclined at an angle of $23^0 27'$, the plane of the ecliptic is inclined to the plane of the equator by the same amount. This angle is called the 'Obliquity of the Ecliptic' and is denoted by ω.

The ecliptic cuts the equator at two points known as the equinoxes. The point that marks sun's sojourn to north of the equator is the Vernal Equinox while the point of crossover to the south is known as autumnal equinox. At the equinoxes when the sun is on the equator it rises exactly on the east and the day and night are of equal length.

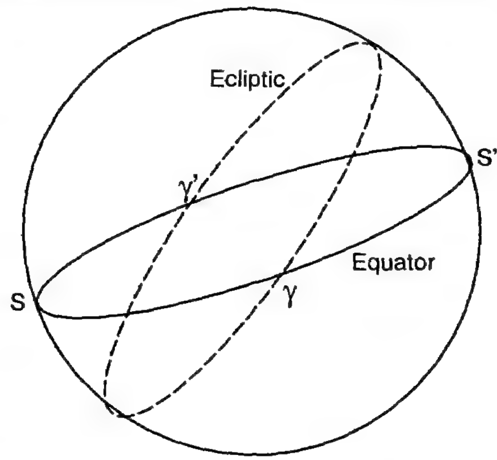


Fig. 5

The solstices are the points on the ecliptic midway between the equinoxes at which the sun assumes maximum declination. The position of maximum southern declination corresponding to minimum daylight time in the northern hemisphere is known as the winter solstice and the position of maximum northern declination which corresponds to maximum daylight in the same hemisphere is referred to as the summer solstice. Figure 5 depicts the equinoxes γ, γ' and solstices S, S'.

The Tropics are the parallels to the equator that passes through the solstices. The path of the sun lies between the Tropics – the northern Tropic is known as the Tropic of Cancer and the southern is called the Tropic of Capricorn.

Tropical and Sidereal Zodiacs

The celestial equator marks the reference plane of zero declination perpendicular to the Earth's axis that extends between the celestial north and south poles. Great circle passing through the object and the celestial poles form the declination circle while the celestial equator forms the circle of right ascension in units of either degrees (360) or hours (24). The apparent path of the Sun, the Ecliptic is inclined at angle of ω to the celestial equator and cuts the equator in two points known as the equinoxes where the declination is obviously zero. Passage of sun from south to north of equator is referred to as the vernal equinox and this happens around 21st of March while the north to south transit of the equator is the autumnal equinox that occurs after six months – about 23rd September. Solstices are the positions of sun at declinations equal to $\pm\omega$, the obliquity of earth's axis and occur respectively around 22nd July and 22nd December. This apparent motion of the sun relative to the equator or the declination cycle is the cause of seasons and is therefore referred to as the seasonal year or Tropical phenomenon.

When the ecliptic plane is selected as the reference plane instead of the celestial equator, we can have a coordinate system of celestial longitude (λ) and latitude (β), the former measured from the vernal equinox [or a fixed point that we may choose over the ecliptic] to the point where the great circle passing through the pole of the ecliptic and the object meets the ecliptic and the latter is measured along the same great circle from the

ecliptic. The measurement from vernal point is referred to as tropical while the choice of a fixed point with reference to the stellar background makes the measurement sidereal.

In contrast to the horizontal coordinate system based on the celestial equator and the celestial poles, the choice of ecliptic plane leads to a far more absolute reference frame as the ecliptic poles are fixed points around which the celestial poles make rounds over a large period of time known as the precession cycle.

• Celestial Co-ordinates

a) Equatorial System: Right Ascension and Declination [α,δ]

Right ascension is the angular distance between the celestial meridian of an object and the conventional zero point known as vernal equinox as measured from the earth eastwards along the celestial equator. Generally the right ascension is measured on a special time scale known as sidereal time. The period of diurnal rotation of the earth is 23 hours 56 minutes 4.09 seconds within which the fixed stars cover an angular distance of 360^0. Mathematical astronomy considers the above duration of a sidereal day as constituted by 24 sidereal hours and this is the unit of right ascension. One sidereal hour as such amounts to 15^0 angular measurement. Vernal equinox being the 0^0, the right ascension of a celestial body is the time interval between the upper transits (culminations) of the vernal equinox and the respective body.

Declination is the angular distance that a body subtends from the celestial equator –akin to the measurement of latitude on the surface of earth – and is positive for objects north of the celestial equator and negative for south.

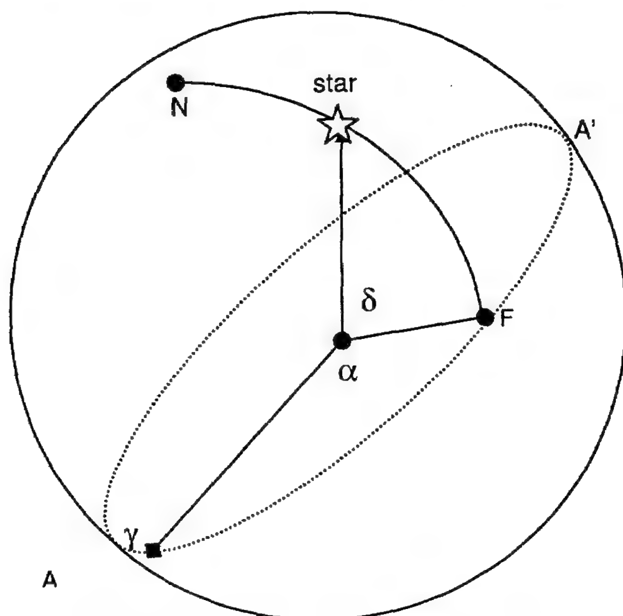


Fig. 6 depicts the celestial equator AγFA' and the measurement of right ascension from γ to F (the foot of the great circle passing through the star and the celestial North Pole N) along the equator. Declination is measured along the great circle FN to the celestial object.

b) Horizontal System: Azimuth and Altitude

Azimuth is the angular distance measured eastwards along the horizon from the north cardinal point (geographical north) to the foot of the vertical through the body. Azimuth of the south and west cardinal points are 180^0 and 270^0 respectively.

Altitude is the angular distance from the horizon along the vertical i.e. great circle passing through zenith and nadir meeting observer's horizon at right angles. It varies from 0^0 to 90^0 on either side. The north latitude of an observer is the altitude of the north celestial pole or approximately that of the pole star.

The altitude and azimuth of a body continually change with time being affected by diurnal motion and the position of the observer.

→Maximum Altitude of a Star

The maximum altitude of a star corresponds to upper transit and is equal to declination plus the colatitude of the observer's position i.e. $\delta + (90^0 -$ latitude).

Stars having declinations greater than the colatitude never dip below the horizon and are called circumpolar stars. Thus for Delhi stars that have declinations greater than (+) $61^0 22'$ are circum-polar. On the other hand stars having southerly declinations greater than the colatitude of the observation point can never rise above the horizon in the northern hemisphere. For example: Stars having southerly declinations greater than (-) $61^0 22'$ can never be observed from Delhi.

Ecliptic System: Celestial Longitude and Latitude [λ,β]

The celestial longitude of a body is the angular distance between the vernal equinox and the foot of the secondary through the body to the ecliptic, measured from west to east. Celestial latitude is the distance from the ecliptic measured along the secondary through the body and this is positive or negative according as the body is north or south of the ecliptic. This system is quite convenient for fixing the position on or near the ecliptic and is unaffected by either diurnal motion or the shift of observer.

Conversion of Coordinates

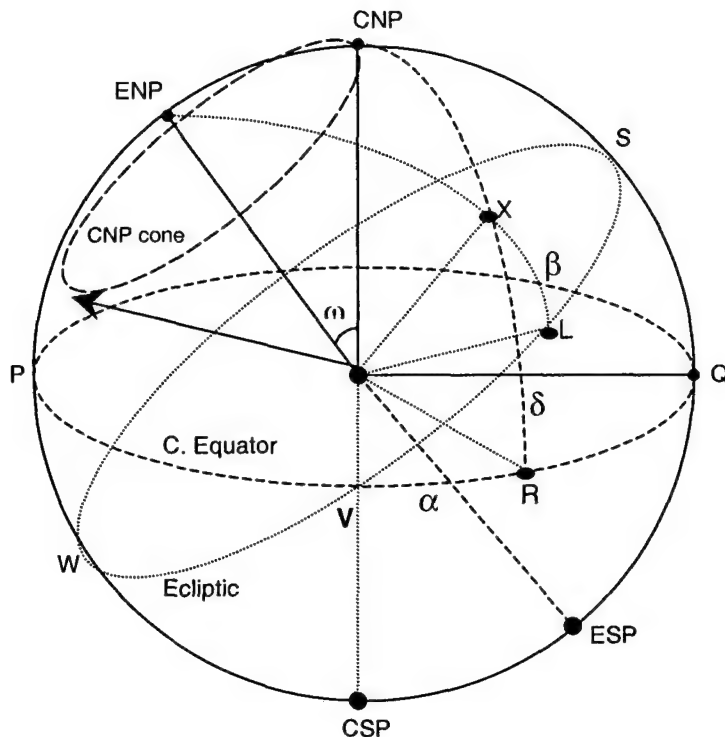
Astronomical information is generally available in either the ecliptic system or the equatorial system. Using the following relationships coordinates of the one system can be converted to the other.

$$\text{Sin } \beta = \text{Cos } \omega \text{ Sin } \delta - \text{Sin } \omega \text{ Cos } \delta \text{ Sin } \alpha$$

$$\text{Tan } \lambda = [\text{Sin } \omega \text{ Tan } \delta + \text{Cos } \omega \text{ Sin } \alpha] / \text{Cos } \alpha$$

$$\text{Sin } \delta = [\text{Cos } \omega \text{ Sin } \beta + \text{Sin } \omega \text{ Cos } \beta \text{ Sin } \lambda]$$

$$\text{Cos } \alpha = [\text{Cos } \lambda \text{ Cos } \beta] / \text{Cos } \delta$$



← *Fig. 7 depicts the ecliptic and* equatorial coordinate systems. V is vernal equinox and VR = α and RX along the great circle passing through the celestial north pole (CNP) is the declination δ. L is the foot of the great circle passing through the ecliptic north pole (ENP) and VL= λ and LX = β, the celestial longitude and latitude respectively. Due to precession of the equinoxes, CNP cuts a cone around ENP of angle 2ω, where ω is the obliquity of the earth's axis or the angle to which ecliptic is inclined to the celestial equator.

• Observing the Sky

Apparent motion of heavenly bodies from east to west is an illusion caused by the rotation of the earth from west to east about its axis. The revolution of the starry sphere observable in the night sky depends on the observer's latitude. When observed from the equator the stars rise and set vertically at right angles to the horizon and the celestial poles can be located on the north and south points of the horizon. As we travel from the equator to the north or south latitudes the poles rise gradually above the horizon to coincide with the zenith at the poles. At the poles the stars of the respective hemisphere trace out circles parallel to the horizon and no rising or setting of stars can be observed. Between the poles and the equator the stars rise and set at an angle oblique to the horizon. The stars close to the celestial poles that neither rise nor set are called circumpolar and they cross the meridian everyday twice – once above the pole at their highest altitude and once below the pole at their lowest altitude. Super imposed on the diurnal rotation is an annual revolution caused by the orbital motion of Earth around the Sun that make the circumpolar stars in the North and South Hemispheres to trace out annually circles around the poles respectively in the anticlockwise and clockwise directions.

Moon's orbit is inclined at an angle of $5^0.145$ to the ecliptic and cuts the ecliptic at two points referred to as the Ascending node (Rāhu) where Moon crosses the ecliptic to the North and Descending Node (Śikhi) where Moon crosses the ecliptic to the South. Mathematically, Nodes are the positions where Moon's latitude is zero and at 90 degrees from these Nodes Moon attains respectively maximum (+)/(-) latitude. Near the Nodes at new moon or full moon with latitude approaching zero Moon causes the eclipses and away from the Nodes it occults stars and planets having nearly equal longitude and latitude. Planets do have their Nodes and similar variation of latitude but over relatively large periods of time as compared to Moon. Visibility of the eclipses and occultation at a particular place are governed by complex astronomical factors not amenable to simple calculations.

Heliocentric Phenomena

Visibility of the heavenly objects is a function of the proximity to the Sun. Naked eye observations of the stars and planets are possible only after sunset and before sunrise controlled by the twilight hours and therefore the planets and stars close to the Sun and diving below / rising at the horizon along with the Sun shall be invisible. Planetary visibility is defined by elongation relative to Sun: Venus and Jupiter (10^0), Moon, Mars and Saturn (15^0), Mercury (10^0 + its visual magnitude). Elongations lesser than these limits means invisibility – the planets heliacally set just before sunset and as a planet is first glimpsed on the eastern horizon during twilight hours it is said to have its heliacal rise. Heliacal visibility of the stars too is a function of the proximity to sun and atmospheric conditions and generally the first magnitude stars are considered to be visible when they heliacally rise with Sun at an altitude of (-) 18^0 (end of astronomical twilight)– approximately an hour before sunrise. Mercury and Venus, the inferior planets whose heliocentric orbits lie within that of the Earth are unable to have elongations exceeding ($\pm$) 28^0 and ($\pm$) 47^0 respectively. Longitudinal conjunctions of the Sun and planets take place at intervals known as synodic periods and the stellar conjunctions of planets occur at intervals known as sidereal periods.

Moon in its synodic motion or elongation cycles exhibit apparent forms known as lunar phases that are cyclically recurring with the periodicity of the synodic period. When divided into four in terms of elongations 0^0, 90^0, 180^0 and 270^0 these phases are called New Moon (Amāvāsya), First Quarter (Śukḷāṣṭami), Full Moon (Pourṇami) and Last Quarter (Kṛṣṇāṣṭami). In ancient India and Babylon this cycle had a division of thirty known as Tithis beginning with the first Tithi of the bright half and ending with the New Moon at elongation intervals of 12 degrees.

- **Brightness and Visibility of Stars**

Hipparchus classified the stars visible to the naked eye in terms of their apparent brightness into six broad classes of visual magnitude 1 to 6 in decreasing order of brightness. 20 brightest stars were assigned a magnitude of 1 and the next 60 given 2 and so on with no cognizance to their relative brightness. Herschel in 1890 brought relative brightness into picture by establishing that the ratio of apparent brightness of two stars differing by one magnitude is equal to 2.512. Thus a star of magnitude 1 is 2.512 times brighter than a star of magnitude 2 and $(2.512)^n$ times brighter than a star of

magnitude n. A first magnitude star is thus a hundred times brighter than a sixth magnitude star. Brightest celestial objects in this scale receive negative numbers as magnitudes such as (-) 26 for Sun, (-) 13 for Moon, Venus (-4), Sirius (-) 1.6, Canopus (-) 0.86 etc.

Visibility of a star or planet of given brightness is a function of its altitude, azimuth and depression of Sun. The *arcus visionis* or altitude difference with Sun for stars up to the third magnitude stars may be empirically found as $\Delta h = 2.1\mu + 10^0$, where μ is the magnitude ≤ 3.[1] For a given depression of the Sun below the horizon, the sky brightness on the same horizon and opposite the Sun differ by about an order of magnitude and Δh gets reduced by $3 - 6^0$ (about 2.5μ).

• Observing the Stars and Constellations

Greek term 'Zodiac' means 'the circle of animals' and we can find this fact clearly mentioned in Vedic literature: Taittirīya Brāhmaṇa: 1.5.4: Prajāpatiḥ paśūnasṛjata, Te nakṣatraṃ nakṣatraṃ upatiṣṭhan. "Prajāpati created the animals; they have ascended to the heaven and occupy the asterisams". Without knowing about the stars and the constellations they shape, the evolution of stellar mythology cannot be understood or appreciated. Starry canopy display a wide range of phenomena such as stars of different color, size, clusters, variable ones etc as well as the innumerable shapes that they together create in the depths of our imagination. The brighter stars have proper names in many languages like Sanskrit, Greek, Arabic and Latin. Bayer classification uses the successive Greek alphabets α, β, γ to flag the stars of a constellation in descending order of apparent magnitude. Flamsteed employed numbers to enumerate and label the stars from west to east across the constellations. The constellational charts are always given as seasonal such as Spring constellations, Winter constellation etc., even though the cardinal points that mark the seasons undergo regression of about 14 degrees in thousand years. What had been the winter constellation in 4000 BC are today the spring constellations and those, which constituted the spring, have become summer constellations. A better approach may be to look at the stars in terms of the 12 Rāśis of the sidereal zodiac or Mūlādhāra Cakra which is immune to precession and is therefore of eternally fixed boundaries.[2] As a recapitulation, the sidereal fixed zodiac has Mūla or λ -Scorpii as fiducial at 240^0 and this means that in AD 233 [JD (TDT) = 1806240.72386111] the vernal equinox coincided the zero point. For J2000, the sidereal zero point was $24^0 35'$ east of the vernal equinox. In this fixed zodiac or Rāśi Cakra, the heavens can be divided into twelve constellational houses by means of great circles passing through the ecliptic north pole and the sign boundaries on the ecliptic at intervals of 30 degrees. Brief accounts of the principal stars that make up the rāśis, nakṣatras and constellations important in the context of stellar mythology are given below:

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[1] Purrington, R.D., 'Heliacal Rising and Setting: Quantitative Aspects', *JHA*, 1988.

[2] Because of the tropical zodiac considered in the West, it is wrongly believed that the 'signs' of the zodiac no longer coincide with the constellation of the same name due to precession of one sign every 2160 years. The constellation boundaries adopted by the International Astronomical Union is arbitrary and has no relation to the traditional concept of a zodiacal house.

Meṣa or Aries

1. Aśvini: α - Arietis: $13^0 05'$ and β-Arietis $09^0 23'$
2. Bharaṇi: 41Arietis $23^0 37'$

Meṣa also has γ (μ = 3.88) and δ (μ = 4.35). Visible in the western sky during early hours before sunrise during October. In terms of sidereal solar months – on the first of Libra at sunrise the first point of Aries will be setting at the western horizon. Before twilight Taurus, Gemini, Cancer and Leo will be visible as the sky is traced towards east.

Vṛṣabha or Taurus

1. Kṛttika: η-Tauri: $35^0 24'$/ $04^0 03'$ [μ = 2.88]; Alcyone; Agniśikha (Gaṇaka Kāḷidāsa)
2. Rōhiṇī: α-Tauri $45^0 12'$ / (-) $05^0 28'$[μ = 0.99]; Aldebaran
3. Mṛgaśīrṣa: γ-Orionis $56^0 22'$/(-) $16^0 49'$[Bellatrix, μ =1.64]; λ-Orionis $59^0 07'$ / (-) $13^0 22'$[μ =3.66]

Taurus, the Steer of heavens is on the east of Aries and has two well-known clusters Hyades and Pleiades.

Mithuna or Gemini

1. Ārdra: α-Orionis $64^0 10'$ / (-) $16^0 02'$ [μ = 0.4 to 1.3: variable]
2. Puṇarvasu: α-Geminorum: $85^0 39'$ / $10^0 06'$[Castor,μ = 1.95]; β-Geminorum: $88^0 38'$/$06^0 41$ [Pollux, μ =1.14]

Orion, the Hunter

Orion can be easily located by the four bright stars, α, γ, β and κ forming a trapezium. The brightest star on the head of Orion is λ -Orionis. Betelgeuse and Bellatrix are referred to as "Bāhumūlaṃ" of Orion.

Orion's Belt

1. δ - Orionis: $57^0 47'$ /(-) $23^0 33'$; Mintaka (μ =2.23)
2. ε - Orionis: $58^0 53'$ / (-) $24^0 30'$; Alnilam (1.70)
3. ζ - Orionis: $60^0 06'$ / (-) $25^0 18'$; Alnitak (1.90)

Aitareya Brāhmaṇa III.33 refers to the Orion Belt as "Iṣutrikāṇḍā".

Eridanus

Eridanus, perhaps the Indian Vaitarani, streams southward from the feet (Rigel:β) of Orion. β And α -Eridani respectively forms the northern and southern tip. Eridanus is so long that the ecliptic longitude of α ($320^0 44'$/ (-) $59^0 23'$) falls in Aquarius. On the right of Eridanus we can find Cetus, the Whale containing the long period variable (period

331days) Omicron Ceti or Mira. This star appears in the Mahābhārata as "Vicitravīrya" meaning – 'of anomalous brilliance'.

Aurigae, the Charioteer

From Orion, across the ecliptic to the North in the Ākāśa Gaṅga or Sindhu we find Aurigae shaped like an irregular pentagon (depicted as 'pañcaśikha' awarded to Jayadratha when he was caught after trying to steal Pāñcāli, in Mahābhārata). Capella or α -Aurigae ($57^{0}16'$ / $22^{0}52'$) is a first magnitude star. Appears as Jayadratha, the Saindhava king in Mahābhārata. On the right of Aurigae, north of Taurus we can find Perseus. Above Orion, Aurigae and Perseus are supposed to form a gate and this fact too appears in the Mahābhārata portrayal of Jayadratha as the king who guarded the gate of Cakravyūha.

Heavenly Dogs

Following the line of Orion's belt to the southeast we can find the brightest star Sirius or α - Canis Major (Dog) [$79^{0}30'$ / (-) $39^{0}36'$], forming an almost equilateral triangle with Betelgeuse and Procyon ($\mu = 0.38$) or α -Canis Minor [$91^{0}12'$ / (-) $16^{0}01'$].

Cancer, the Crab

Crab is the smallest constellation and all stars are only faintly visible. Praesepe (M44) or Beehive, an open cluster visible to the naked eye as a hazy cloud lies between γ and δ Cancri, about 10^{0} south of Pollux. β -Cancri ($\mu = 3.52$) [$99^{0}40'$/ (-) $10^{0}17'$] and α - Cancri ($\mu = 4.25$)[$109^{0}03'$ / (-) $05^{0}05'$] are on the south of the ecliptic with δ exactly over ecliptic [$104^{0}08'$]. Iota (4.02) is on the south [$101^{0}46'$ / (-) $10^{0}26'$] along with ε -Hydrae (3.38) at $107^{0}46'$/ (-) $11^{0}06'$.

Leo

East of Cancer is the Lion with Maghā or α - Leonis (Regulus, $\mu = 1.35$) on the ecliptic [$125^{0}15'$, $0^{0}28'$ which form the Lion's heart. Denebola (U.Phālguni, $\mu = 2.14$) or β - Leonis [$147^{0}02'$ / $12^{0}16'$] can be found at the tip of the tail. Other important stars include δ-Leonis (P. Phālguni), [$136^{0}44'$/ $14^{0}20'$], θ-Leonis [$138^{0}50'$ / $09^{0}40'$] and 93-Leonis (U. Phālguni) [$144^{0}23'$ / $17^{0}19'$].

Virgo

Brightest star of the constellation is Spica or α - Virginis [$179^{0}15'$] located two degree south and others are on the north like β-Virginis (Barking Dog) [$152^{0}35'$/ $00^{0}44'$], δ [$166^{0}53'$ /$08^{0}37'$] and ε-Virginis (Vindemiatrix) [$165^{0}21'$/ $16^{0}12'$]. All these stars have figured prominently in Hindu mythology.

Saptarṣis or Ursa Major

Details of the seven bright stars that represent the Saptarṣis have been already given in the section on Vedic astronomy. Mizar or Vasiṣṭha is a double having a faint companion Alcor, known in India as Arundhati. A line drawn through α and β meets the Polaris and these stars are therefore called pointers. In view of this fact it was wrongly construed that the constellation itself has a movement like the celestial pole.

Hydra, Crater and Corvus

Hydra, the water snake, Crater – the Cup and Corvus – the Crow can be found on the south of Virgo and Leo. The solsticial colure had passed through the head of Hydrae around BC 1000. α - Hydrae, the brightest star (μ = 1.98) is at $122^0 42'$ / (-) $22^0 23'$ and the constellation figures prominently in the initial chapters of Mahābhārata where we find the stories of Pitṛs and Serpents. North of Hydra and south of Zavijava (β - Virginis) is the Crater made of four stars and moving further east we find the Crow as a group of five. These five stars in India had the name Hasta (χ - Corvi at $168^0 52'$ / (-) $12^0 11'$) and was also the Gāṇḍīva of Arjuna (U. Phālguni).

Southern Cross and Centarus

South of Hydrae in the Milky Way are the bright constellations Crux and Centarus. The four principal stars [α - Crucis or Acrux, β, γ and δ] of Crux forms a cross. Crux also contains the dark nebula called Coal Sack surrounded by the brighter Milky Way. Certain scholars have attempted to trace the legend of Triśaṅku and Viśvāmitra to these groups. Crux is now wholly invisible beyond 35^0 N and in the southern hemisphere it is circumpolar in regions beyond 35^0S, very much like the Great Bear or Saptarṣis in the North. During ancient times such as 4000 – 3000 BC it was visible even from 50^0N. The axis of Crux points toward the south celestial pole and α-Crucis or Acrux is close to the South Pole. It is this proximity to the South Pole that probably created the myth of Viśvamitra attempting to create a new heaven for Triśaṅku in opposition to the wishes of Vasiṣṭha, Mizar of the Great Bear.

Libra and Scorpio

This is a constellation of faint stars; α - Librae [$200^0 30'$ / $0^0 20'$] or Viśākha (Rādha) is on the ecliptic and forms a triangle with δ and β just outside the Milky Way. Straddled to Libra on the southeast in the Milky Way are the stars of Scorpio led by Antares [α-Scorpii: $225^0 11'$ / (-) $04^0 34'$](Jyeṣṭhā Rohiṇī). Antares, a red super giant that rivals Mars in color is the most popular character of the Vedas – Indra, the genesis of the respective hymns may belong to the epoch when the solsticial colure had been passing through Antares. β - Scorpii (Anurādha) lies one degree south of the ecliptic at $218^0 36'$. In the solar month of Sagittarius, Scorpio can be seen an hour before sunrise on the east, a little towards south.

Sagittarius – the Archer

On various occasions in the preceding parts we have discussed the prominent role played by this constellation in the story of Mahābhārata and Rāmāyaṇa. Mūla, synonym of Mṛtyu / Nirṛti marked the boundary with Scorpio and is very near to the Galactic center SgrA*. Mūla or λ - Scorpii is at 240^0 / (-) $13^0 47'$ as the fiducial star marking the Mūlādhāram. Atharvaveda (VI.110.2) has credited this star to Yama and the Ṛgveda (X.14.10-11) has depicted λ and ι - Scorpii as the two dogs guarding the path of manes. Milky Way splits off here in two parts – one part flows over Scorpio / Ophiucus and the other over Aquilae. γ - Sagittarius (μ = 2.99): $246^0 41'$ / (-) $06^0 59'$; δ - Sagittarii (2.7) is at 250^0/ $06^0 28'$ south, λ at $251^0 44'$ /$02^0 08'$ (μ = 2.81), ε at $250^0 30'$/$11^0 03'$ while the brightest Vega is at $260^0 44'$/ $61^0 44$ and belongs to Lyra of the North.

Ophiucus, Serpens and Hercules

Against Scorpio and Sagittarius on the north of the ecliptic are the big constellations Ophiucus and Hercules. These constellations too have played a significant role in the epic war story as great warriors but we are short of details as to identify the specific characters with either of them.

Capricorn, Delphinus, Aquarius, Cygnus, Aquilae

In this sector Aquilae, Delphinus and Cygnus had been the dominant characters of epic *mythology*. α-*Aquilae* (*Śravaṇa*, μ=0.77) [$277^0 11'$ /$29^0 18'$], β [$277^0 50'$/$26^0 40'$] and γ [$276^0 21'$/$31^0 15'$], which point towards Vega have been in mythology the three footsteps of Viṣṇu that vanquished Mahābali. η -Aquilae [$275^0 50'$/ $21^0 31'$] is a variable whose magnitude varies between 3 and 4 in a period of 7 days 4 hours. Beyond the Milky Way, northeast of Aquilae are the Dolphins – which Sengupta considered as Śiśumāra in preference to the Little Bear. α -Delphini [$292^0 48'$ /$33^0 01'$] and β [$291^0 44'$ /$31^0 55'$] are the yogatāras. East of Vega and south of Aquaris is the Swan or Cygnus in the Milky Way that can be easily located by the four prominent stars forming a cross. Deneb [α-Cygni: $310^0 45'$/$59^0 54'$, μ =1.25], the brightest star is on the tail of Cygnus that is flying towards south through the Milky Way. Between Cygnus and Aquilae are minor groups Sagitta – the Arrow, Vulpecula –the Fox, Equus –the little Horse that has participated in the great epic war. Aquarius has no star of remarkable of brilliance. α - Aquarii is at $308^0 46'$/$10^0 40'$ and λ at $316^0 59'$/(-) $0^0 23'$. South of Aquarius is the bright star Formalhaut, α of Piscis Austrinus [$309^0 16'$ / (-) $21^0 08'$], known as the southern fish.

In Greek mythology Aquilae, the eagle or Altair, the flying one is the messenger of Zeus or Jupiter. As the Eagle sets with the tail first touching the horizon the Dog-star Sirius (Varāha) rises in the east. Altair forms a great triangle with Deneb of Cygnus and Vega of Lyra.

Pegasus, Andromeda, Perseus and Pisces

Pegasus, the winged horse flying southeast of Cygnus is best known for its great square of stars formed by second magnitude stars. Alpheratz (navel of the horse) forming the

northeast corner is α of Andromedae [349°43' /25°41'] and others are: α -Pegasi at lower right corner [328°54' /19°24'], β at upper right corner [334°47' /31°08'], and γ at lower left corner [344°34' /12°36']. β and γ of Andromeda are in line with α of the great square and the line when extended meets α of Perseus. Perseus is famous for the meteor shower 'Perseids' occurring from 10th to 12th of August. β - Perseus or Algol is a magnificent variable [μ = 2.3 for 2 days and 11 hours, then 3.5 for 5 hours followed by brightening for 5 hours and remains at 2.3 for the next 59 hours in a cycle]. Directly below the great square of Pegasus is a circle of stars that marks the western fish also known as Circlet in the west end of Pisces. These stars make their appearance in Mahābhārata as the son Citrāṅgada (meaning star-bangle) of Matsyakanyā Satyavati. Pisces has no bright star η (μ =3.62) is at 02°14' /05°23' while ζ -Piscium is on the ecliptic at 355°17'.

North of Andromeda in line with Polaris and and ε - Ursae Majoris is the constellation Cassiopeia, the Lady in the Chair. Next to her is Cepheus, the King of Milky Way. μ - Cephei is the reddest star of the northern hemisphere. North of Cepheus and west of Polaris is Draco, extending half way round the sky between Cassiopeia and Ursae Major.

In Greek mythology Andromeda is the exceptionally beautiful daughter of daughter of King Cepheus and Queen Cassiopeia. She was forsaken by the King to save the kingdom from the wrath of the Sea God but was saved by Perseus with the help of Pegasus. Cetus is a sea monster in the story that got reduced to a stone as Perseus showed the head of Medusa. Patch of light M31 of magnitude 3.5 is the spiral galaxy Andromeda nearest to the Milky Way.

These constellations and stars can be systematically observed by following a sidereal calendar. At the beginning of Aries, two hours before sunrise the constellation west of Aries by one rāśi can be conveniently observed. Similarly, an hour after sunset the 7th / 8th to the 2nd one can be observed with the 4th / 5th rāśi at the zenith. Any given object other than the fast moving Moon reaches back to its position four minutes earlier for successive nights. This totals to 2 hours and thus a rāśi replaces another in a month's time and a star or rāśi rising at 12 PM on any day will rise two hours early at about 10 PM after a month.

- **Heliacal Rising Stars in 4137 BC**

Modern astronomical data of the heliacal rise phenomenon of the great epoch of 4137 BC as derived from the planetarium software Skymap pro is provided below so that interested readers may look for any correlation that may exist with some popular myths of the epics and purāṇas. In the year 4137 BC, the cardinal points coincided with the quarters of fiducial star Mūla which were sign boundaries or initial points of Sagittarius, Pisces, Gemini and Virgo. Heliacal rising stars of autumnal equinox therefore represent the heliacal rise phenomena for sun's transit of the first point of Sagittarius and those of winter solstice, spring equinox and summer solstice respectively formed the heliacal rise phenomena for the beginning of the solar months of Pisces, Gemini and Virgo.

Vernal equinox: 23rd April 4137 BC 12:35 UT: Sunrise: 06:01LMT and Sunset 18:08 LMT [Delhi]

(Sidereal solar ingress to Mithuna)

Sunrise JD [UT]: 210496.53611: At sunrise α - Aurigae had an altitude of 18^{0}25’ and azimuth of 77^{0}08’. It rose at 04:31 when Sun’s altitude was (–) 20^{0}37’ and azimuth 78^{0}33’. Mirfak or α - Persei had already risen [rising at 03:15] at this time and its altitude was 15^{0}31’ and azimuth 77^{0}11’. Zeta – Persei risen at 04:26 was just above the horizon. Cetus, Andromeda, Pegasus, and Pisces could be seen in the eastern sky. In the west ι - Librae was 1^0 below the horizon and Scorpio was about to set while α-Bootes [towards North] had an altitude of 11^{0}14’ and azimuth 326^{0}36’. In the North α-Lyrae or Vega [Upper transit: 03:23] had an altitude of 66^{0}28’ azimuth of 330^{0}36’ and the Ursae Major had partly risen; γ, β, xi, δ, ε, chi, zeta, eta, θ and ι - Draconis and β - Ursae Minor were all circumpolar while α - Ursae Minor or present Polaris was not circumpolar at New Delhi. α - Cygnus had an altitude of 78^{0}12’ and azimuth 48^{0}07’ and culminated at 05:22 LMT. Serpentis, Opheucus, Hercules, and Cepheus could also be seen. South had Cetus, Grus and Aquarius with α - Aquilae high up in the sky after transit at 03:02 LMT. Equator could be found passing through ε - Pegasi or Enif.

Venus rose at 04:45 with α of Perseus at an altitude of (+) 18^{0}32’ and Aurigae at altitude of (+) 2^{0}36’ while sun was below the horizon at (-) 17^{0}35’. On the west λ-Scorpii had an altitude of (+) 725’ and azimuth 252^{0}21’ with the setting time of 05:22 LMT.

- **Summer solstice 25th July 4137 BC, 23:38 UT: Sunrise:0456 and Sunset: 1856 LMT**

(Sidereal solar ingress to Kanyā)

Sunrise 26th July 04:56, JD [UT]: 210590.49097. α - Leonis [risen at 03:17] had an altitude of 19^{0}53’ and azimuth 75^{0}11’ while δ-Cancri risen at 0204 had the altitude of 36^{0}50’ & azimuth 90^{0}27’. At the rise of α-Leonis sun’s altitude and azimuth were (-) 18^{0}38’ & 47^{0}46’ respectively. δ - Cancri: Altitude (+) 15^{0}09’, Azimuth 79^{0}27’, Procyon (α-Canis Minor: rise 0217): (+) 12^{0}40’; 98^{0}35’;Sirius or α - Canis Major (rise at 0315): 00^{0}22’, 121^{0}06’; α - Orionis (Betelgeuse) (+) 25^{0}34, 123^{0}51: Zeta Orionis: (+) 18^{0}25’, 131^{0}22’; δ - Geminorum: (+) 28^{0}29’, 95^{0}40’; Pollux or β-Geminorum: 29^{0}52, 85^{0}23’;Castor [α-Geminorum]: (+) 34^{0}57’, 85^{0}43’; Aldebaran [α-Tauri]: (+) 41^{0}38’, 141^{0}18’, Upper transit at 0511: Capella [α -Aurigae]: (+) 63^{0}21’, 103^{0}01’, Upper transit at 0507; α - Persei: (+) 77^{0}40’, 142^{0}38’, Upper transit at 0348; α-Ursae Minoris: (+) 61^{0}01’, 00^{0}21’, Upper transit at 0318;

As α - Leonis rose on the East, Mars [(+) 00^{0}37’, 236^{0}45’, setting at 0321], Altair [α-Aquilae: (+) 01^{0}25’, 285^{0}23’, setting at 0325], Aquarius, Cetus, Pisces, Pegasus, Delphinus and Cygnus could be seen above the western horizon. α - Persei: (+) 77^{0}40’, 142^{0}38’, Upper transit at 0348; γ -Andromedae: (+) 71^{0}22’, 200^{0}24’, Upper transit at 0251; On the North, Hercules, Lyrae, Cygnus and Cepheus could be seen while in the southern sky Monocerotis, Orion, Lepus, Eridanus, Cetus, Taurus, Aries and Pisces were visible.

• Autumnal Equinox: 23rd October 02:04: Sunrise: 0601LMT:Sunset: 1808 LMT

(Sidereal solar ingress to Dhanu)

At the time of sunrise Mercury had an altitude of (+) 20^{0}34’, azimuth 88^{0}53’ [rising:0424] and was conjunct δ-Scorpio (+) 21^{0}04’, 92^{0}35’, rise:0423; As δ - Scorpii rose at 0423, Sun had altitude (-) 22^{0}12’ & azimuth 77^{0}13’. Important stars on the east were: δ - Opheuchi: (+) 02^{0}16’, 61^{0}44’, rising at 0410; θ-Centauri [Menkent]: (+) 15^{0}28’, 103^{0}03’, rising at 0310; β - Centauri (+) 01^{0}37’, 123^{0}48’, rising at 0413; Acrux (α1-Crucis): (+) 06^{0}40’, 134^{0}21’ rising 0340; α - Virginis: (+) 37^{0}45’, 86^{0}57’; α -Bootes: (+) 34^{0}27’, 41^{0}27’; α - Leonis: (+) 83^{0}28’, 187^{0}18’, transiting at 0419: α - Hydrae (Alphard): (+) 60^{0}23’, 178^{0}22’, transiting at 0426; π-Hydrae: (+) 21^{0}25’, 95^{0}48’: β - Corvi: (+) 39^{0}07’, 108^{0}56’;

On the West α -Persei [Mirfak]: (+) 03^{0}27’, 289^{0}09’, was to set at 0441LMT along with Aldebaran: 06^{0}54’, 253^{0}07’ setting at 0457LMT. α - Aurigae was above Rohiṇi at 20^{0}38’, 281^{0}50’; β - Orionis (Rigel): 08^{0}53’, 226^{0}05’; Sirius: 27^{0}29’, 210^{0}13, transit 02:23’; Procyon: 49^{0}01’, 228^{0}24’, transiting at 0226; δ - Cancri (Asellus Australis): 65^{0}37’, 245^{0}01’, transiting at 0251; α -Hydrae: 60^{0}23’, 178^{0}22’, transit at 0426:

In the North γ - Draconis (Eltanin) was at its lowest altitude 00^{0}37’ (azimuth = 02^{0}38’) along with Hercules about to set. Above them were Ursae Minor and Bootes respectively. Eridanus, Cetus, Aries, Cassiopeia (ε - Cas (+) 00^{0}28’) and part of Cepheus were below the horizon. In the South, α - Carinae (Canopus) 03^{0}03’, 179^{0}26’, transiting at 0427LMT had above Acrux (α1–Crucis) at altitude 06^{0}40’, azimuth 134^{0}21’, rising 0340; Velorum, Puppis and Monocerotis on the galactic equator. Canis Major [α -CM at 27^{0}29’, 210^{0}13’], Leporis [β - Leporis at 07^{0}45’, 213^{0}09’] and Orion [β - Orionis or Rigel at 08^{0}53’, 226^{0}05’] were in the southeast.

• Winter Solstice: 20th January 4136 BC, 0545 UT, 210768.5253: Sunrise 0705 LMT

(Sidereal solar ingress to Mīna)

At the time of the solstice Sun had the altitude of (-) 16^{0}56’ and azimuth 108^{0}43’. Jupiter: 07^{0}40’, 119^{0}49’; Saturn: 22^{0}53’, 125^{0}28’; δ - Capricorni or Deneb Algedi: 11^{0}16’, 122^{0}23’(rise 0445); α - Gruis: 04^{0}08’, 153^{0}12’; α - Aquilae: 40^{0}52’, 95^{0}55’: Vega: 42^{0}53’, 49^{0}32’: The great square of Pegasus was below the horizon with ε - Pegasi (Enif) at 12^{0}03’, 96^{0}22, rising 0449; In the west Regulus [(-) 05^{0}18’, 298^{0}24’] had set at 0521 with Crateris [δ at (+) 11^{0}31’, 270^{0}47’], Corvus [γ at 24^{0}44’, 266^{0}39’] and Virgo [Spica 42^{0}12’, 270^{0}46’] above. λ -Scorpii was at (+) 49^{0}49’, 177^{0}13’, and transit was at 0553.

In the North α - Ursae Minoris [(+) 00^{0}27’, 16^{0}46’] had risen at 0537 LMT, Draco, Hercules, Bootes etc were above and in the South Pavonis, Trianguli Australis, Arae, and Centaurus could be seen.

These four sets of stellar phenomena can be now observed (subject to factors controlling visibility) respectively at the beginning of the solar months of Gemini, Virgo, Sagittarius and Pisces. At the beginning of the next month these stellar phenomena will occur nearly two hours earlier.

- **Rising and Durations of Rāśis for J2000**

To understand the rising time of rāśis the easiest method is to view the phenomena in relation to sun. When the sun has a sidereal longitude of 0^0, the first point of Meṣa rises at sunrise and sets at sunset. The seventh sign from the rising sign or the point 180^0 away from the rising point always represents the setting point in the west. As the sidereal longitude advances the rising point at sunrise shifts by one degree towards east and in one month when sun attains a longitude of thirty degrees the sign Vṛṣabha replaces Meṣa as the rising sign at sunrise. Each rāśi remains in the ascendant for their respective durations and is then succeeded by the next one. Duration of the rāśis is a function of the declination of their boundaries – their position relative to the celestial equator and the vernal equinox. For the epoch J2000, the durations of the Mūlādhāra signs for the latitude of 10^0 are:

Rāśi 0^0	Declination	RA h-m-s	ST*of rising	Interval h-m-s
Meṣa	$09^0$31'34"	01-31-05	19-24-18	01-50-44
Vṛṣabha	$18^0$54'58"	03-28- 54	21-15-03	02-03-55
Mithuna	$23^0$19'43"	05-36-25	23-18-58	02-11-22
Kaṭaka	$21^0$12'20"	07-46-01	01-30-20	02-07-37
Siṃha	$13^0$19'37"	09-47-31	03-37-57	02-00-39
Kanyā	$02^0$09'03"	11-40-07	05-38-36	01-59-16
Tulā	$-09^0$31'34"	13-31-05	07-37-52	02-04-53
Vṛścika	$-18^0$54'58"	15-28-54	09-42-45	02-11-06
Dhanu	$-23^0$19'43"	17-36-25	11-53-51	02-07-51
Makara	$-21^0$12'20"	19-46-01	14-01-43	01-55-23
Kuṃbha	$-13^0$19'37"	21-47-31	15-57-06	01-44-32
Mīna	$-02^0$09'03"	23-40-07	17-41-38	01-42-40

* ST: Sidereal time

For any other latitude these values may be calculated using the expressions:

Declination: $\delta = \text{Sine}^{-1}$ [Sine ω. Sine λ]

Right ascension: $\alpha = \text{Cos}^{-1}$ [Cos λ/ Cos δ]

Hour angle: h = {Cos^{-1} [-Tan ϕ. Tan δ]}/15

Sidereal time of rising of the ecliptic point = 24 -h + α.

In these expressions ω is the obliquity of the earth's axis (= $23^0.4329111$ for J2000) and λ is the celestial longitude of the ecliptic point for which the rising time is required. λ for the boundaries of each sign is obtained by adding multiples of 30^0 to the ayanaṃśa of the epoch. For J2000 λ for the initial point of Meṣa will be $24^0$35'09" and additions of 30 yields other boundaries. Sidereal interval can be converted to civil time by dividing it with 1.00273790935 and vice versa. Sidereal time for the local mean noon of any date may be found as λ /15 where λ is the tropical mean longitude of Sun for 1200 LMT.

• Orbital Motion of the Planets

As brought out by Kepler the planets move round the sun in elliptical orbits having the sun at a focus. The point of the orbit closest to the sun is called perihelion while the farthest point is referred to as aphelion and these are the extremities (apsides) of the major axis (apsidal line) of the orbit. The longitudes of the apsides are the apparent ecliptic longitude of the sun in transit of these points. All planets have their apsides and in the case of Moon, they are respectively called as perigee and apogee in the orbit round the earth. Perihelion and aphelion are the vertices of fast and slow motion respectively.

Sidereal Positions of the Nodes and Apsides for J2000

Object	Perihelion	Aphelion	Node	Inclination	Tropical period	Synodic period
Earth	$78^0$21'	$258^0$21'	$335^0$25'	0^0	365.24219	-
Moon	$58^0$46'	$138^0$46'	$100^0$11'	$5^0$9'	27.32158	29.53059
Mercury	$52^0$52'	$132^0$52'	$23^0$45'	$7^0$0'	87.96843	115.8775
Mars	$311^0$28'	$131^0$28'	$24^0$58	$1^0$51'	686.92971	779.9361
Jupiter	$349^0$45'	$169^0$45'	$75^0$53'	$1^0$18'	4330.59576	398.8840
Venus	$106^0$59'	$286^0$59'	$52^0$06'	$3^0$24'	224.69543	583.9214
Saturn	$68^0$28'	$248^0$29'	$89^0$05'	$2^0$29'	10746.9404	378.0919

Planets have their quickest motion at the perihelion and they are slowest at the aphelion. At the Nodes they move over the ecliptic to either south or north attaining maximum latitudes at 90^0 away from the Nodes. A conjunction in latitude and longitude between two objects may cause occultation that may or may not be visible at a particular place. Computation of visibility of occultation is complex as in the case of solar eclipses.



Appendix – IV

SIDEREAL ZODIAC – ASTRONOMICAL PHENOMENON?

Sidereal Zodiac is generally viewed as non-phenomenal and exclusively computational in origin. Such a view may not be very correct as may be understood from the following data that suggests sidereal Aries ingress coinciding Caitra śuklạ (1). AD 231[1] is the epoch closest to the Zero Ayanāṃśa year AD 233 of Mūlādhāra Rāhu-Śikhi Cakra.

Year: AD	New Moon, JD	Sun& Moon	Ayanāṃśa	Sun & Moon (sidereal)
231	1805510.0238655	359°48'	0° 0' 0"	359°48'
391	1863950.9322116	01°55'	2°13'8"	359°42'
551	1922391.7589740	03°56'	4°26'21"	359°30'
711	1980832.5703931	05°58'	6°39'39"	359°18'
871	2039273.4313133	08°02'	8°53'02"	359°09'
1031	2097714.3768657	10°11'	11°06'31"	359°04'
1191	2156155.4109097	12°26'	13°20'06"	359°06'
1351	2214596.5296225	14°44'	15°33'46"	359°10'
1511	2273037.7239505	17°09"	17°47'32"	359°22"
1831	2389920.1674570	21°59'	22°15'22"	359°44'
1991	2448361.3177817	24°21'	24°29'25"	359°52'
2151	2506802.3972630	26°39'	26°43'34"	0°05'

The following data of sidereal Aries ingress is illustrative of another facet of the phenomenon: Even if the 160 year cycle of Caitra śuklạ (1) wears off in the course of time, at epochs ± 19 years (such as AD 212, 250, 2132, 2150 etc.) Caitra śuklạ prathama can be found to coincide with the sidereal Aries ingress.

Year	Date [TT]	JD	Ayanāṃśa	Sun	Moon
AD 212	21 March 03:10	1798570.632130	+ 0°15'47"	0°	09°02'
AD 231	21 March 17:30	1805510.229080	0°	0°	02°27'
AD 250	21 March 08:01	1812449.834230	0°15'49"	0°	07°15'
AD 1972	14 April 01:55	2441421.579861	24°13'29"	0°	03°13'
AD 2010	14 April 19:52	2455301.327778	24°45'20"	0°	03°36'
AD 2132	16 April 02:50	2499862.618055	26°27'38"	0°	04°50'
AD 2170	16 April 20:39	2513742.360417	26°59'29"	0°	04°50'

[1] Precession arc during J2000 – AD 231 is 24°36'43".087.

We have already seen in Chapter VI on Tāntric Astronomy that the sidereal ingress into signs Kanyā to Mīna has coincided the beginning of Śukḷapakṣa at intervals of 160 years ever since 4137 BC.



Appendix – V

AYANĀṂŚA

Mūlādhāra Zero Point of J2000.5 [July 2^d.125]

Sidereal fixed or fiducial longitude of Mūla = 240^0
Tropical longitude of Mūla for J2000.5 = 264^0 35' 33".76
Ayanāmśa [J2000.5] = 24^0 35' 33".76 [24^0.59271111]

Ayanāmśa [J2000] = 24^0 35' 33".76 – 25".144 = 24^0 35' 08".62 [24^0.58572667]

Ayanāṃśa [J1900] = 24^0 35' 08".62 - 01°23'47".639 = $23^0$11'20".98

Ayanāṃśa [J1800] = 24^0 35' 08".62 - 02°47'32".987 = $21^0$47'35".63

Zero precession epoch: 1st February 233, 10:46: JD = 1806192.9486111.

Interval	Precession	Epoch	Ayanāṃśa
J2000 – J1900	-01°23'47".570	J1900	$23^0$11'21"
J2000 – J1800	-02°47'32".918	J1800	$21^0$47'36"
J2000 – J1700	-04°11'16".043	J1700	$20^0$23'53"
J2000 – J1600	-05°34'57".086	J1600	$19^0$00'12"
J2000 – J1500	-06°58'34".538	J1500	$17^0$36'34"
J2000 – J1400	-08°22'11".149	J1400	$16^0$12'57"
J2000 – J1300	-09°45'45".549	J1300	$14^0$49'23"
J2000 – J1200	-11°09'17".742	J1200	$13^0$25'50"
J2000 – J1100	-12°32'47".733	J1100	$12^0$02'21"
J2000 – J1000	-13°56'15".526	J1000	$10^0$38'53"
J2000 – J900	-15°19'41".128	J900	$9^0$15'27"
J2000 – J800	-16°43'04".545	J800	$7^0$52'4"
J2000 – J700	-18°06'25".783	J700	$6^0$28'43"
J2000 – J600	-19°29'44".850	J600	$5^0$5'24"
J2000 – J500	-20°53'01".753	J500	$3^0$42'07"
J2000 – J400	-22°16'16".501	J400	$2^0$18'52"
J2000 – J300	-23°39'29".104	J300	$0^0$55'40"
J2000 – J200	-25°02'39".569	J200	+ $0^0$27'31"
J2000 – J100	-26°25'47".908	J100	+ $1^0$50'39"
J2000 – J0	-27°48'54".130	J0	+ $3^0$13'46"

AYANĀṂŚA J2000 - J2100

Year	Ayanāṃśa	Year	Ayanāṃśa	Year	Ayanāṃśa
2000	24^{0} 35’ 8”.62	2034	25^{0} 03’ 38”.61	2068	25^{0} 32’ 08”.73
2001	24^{0} 35’ 59”.01	2035	25^{0} 04’ 28”.87	2069	25^{0} 32’ 59”.14
2002	24^{0} 36’ 49”.26	2036	25^{0} 05’ 19’.14	2070	25^{0} 33’ 49”.40
2003	24^{0} 37 39”.52	2037	25^{0} 06’ 09”.54	2071	25^{0} 34’ 39”.67
2004	24^{0} 38 29”.77	2038	25^{0} 06’ 59”.80	2072	25^{0} 35’ 29”.44
2005	24^{0} 39’ 20”.16	2039	25^{0} 07’ 50”.06	2073	25^{0} 36’ 20”.35
2006	24^{0} 40’ 10”.42	2040	25^{0} 08’ 40”.32	2074	25^{0} 37’ 10”.62
2007	24^{0} 41’ 00”.67	2041	25^{0} 09’ 30”.72	2075	25^{0} 38’ 00”.89
2008	24^{0} 41’ 50”.93	2042	25^{0} 10’ 20’.99	2076	25^{0} 38’ 51”.16
2009	24^{0} 42’ 41”.32	2043	25^{0} 11’ 11’.25	2077	25^{0} 39’ 41”.57
2010	24^{0} 43’ 31”.58	2044	25^{0} 12’ 01’.51	2078	25^{0} 40’ 31”.84
2011	24^{0} 44’ 21”.83	2045	25^{0} 12’ 51’.91	2079	25^{0} 41’ 22”.11
2012	24^{0} 45’ 12”.09	2046	25^{0} 13’ 42”.18	2080	25^{0} 42’ 12”.38
2013	24^{0} 46’ 02”.49	2047	25^{0} 14’ 32’.44	2081	25^{0} 43’ 02”.79
2014	24^{0} 46’ 52”.74	2048	25^{0} 15’ 22’.71	2082	25^{0} 43’ 53”.07
2015	24^{0} 47’ 43”.00	2049	25^{0} 16’ 13”.11	2083	25^{0} 44’ 43”.34
2016	24^{0} 48’ 33”.26	2050	25^{0} 17’ 03”.37	2084	25^{0} 45’ 33”.61
2017	24^{0} 49’ 23”.65	2051	25^{0} 17’ 53”.64	2085	25^{0} 46’ 24”.02
2018	24^{0} 50’ 13”.91	2052	25^{0} 18’ 43”.90	2086	25^{0} 47’ 14”.29
2019	24^{0} 51’ 04’.17	2053	25^{0} 19’ 34”.31	2087	25^{0} 48’ 04”.57
2020	24^{0} 51’ 54’.42	2054	25^{0} 20’ 24”.57	2088	25^{0} 48’ 54”.84
2021	24^{0} 52’ 44”.82	2055	25^{0} 21’ 14”.84	2089	25^{0} 49’ 45”.25
2022	24^{0} 53’ 35”.08	2056	25^{0} 22’ 05”.10	2090	25^{0} 50’ 35”.52
2023	24^{0} 54’ 25”.34	2057	25^{0} 22’ 55”.51	2091	25^{0} 51’ 25”.08
2024	24^{0} 55’ 15”.60	2058	25^{0} 23’ 45”.78	2092	25^{0} 52’ 16”.07
2025	24^{0} 56’ 05”.99	2059	25^{0} 24’ 36”.04	2093	25^{0} 53’ 06”.48
2026	24^{0} 56’ 56”.25	2060	25^{0} 25’ 26”.31	2094	25^{0} 53’ 56”.76
2027	24^{0} 57’ 46”.51	2061	25^{0} 26’ 16”.71	2095	25^{0} 54’ 47”.03
2028	24^{0} 58’ 36”.77	2062	25^{0} 27’ 06”.98	2096	25^{0} 55’ 37”.31
2029	24^{0} 59’ 27”.17	2063	25^{0} 27’ 57”.25	2097	25^{0} 56’ 27”.72
2030	25^{0} 00’ 17”.43	2064	25^{0} 28’ 47”.52	2098	25^{0} 57’ 18”.0
2031	25^{0} 01’ 07”.69	2065	25^{0} 29’ 37”.92	2099	25^{0} 58’ 08”.27
2032	25^{0} 01’ 57’.95	2066	25^{0} 30’ 28”.19	2100	25^{0} 58’ 58”.55
2033	25^{0} 02’ 48’.35	2067	25^{0} 31’ 18”.46	2101	25^{0} 59’ 48”.82

AYNĀṂŚA [J2000 – J1900]

Year	Ayanāṃśa	Year	Ayanāṃśa	Year	Ayanāṃśa
2000	24° 35'0 8".76	1966	24° 06' 39".02	1932	23° 38' 09".53
1999	24° 34' 18".60	1965	24° 05' 48".77	1931	23° 37' 19".29
1998	24° 33' 28".11	1964	24° 04' 58".39	1930	23° 36' 29".06
1997	24° 32' 37".86	1963	24° 04' 08".14	1929	23° 35' 38".82
1996	24° 31' 47.47	1962	24° 03' 17".89	1928	23° 34' 48".44
1995	24° 30' 57".21	1961	24° 02' 27".65	1927	23° 33' 58".20
1994	24° 30' 06".96	1960	24° 01' 37".27	1926	23° 33' 07".97
1993	24° 29' 16".71	1959	24° 00' 47".02	1925	23° 32' 17".73
1992	24° 28' 26".32	1958	23° 59' 56".78	1924	23° 31' 27".36
1991	24° 27' 36".07	1957	23° 59' 06".53	1923	23° 30' 37".12
1990	24° 26' 45".81	1956	23° 58' 16".15	1922	23° 29' 46".88
1989	24° 25' 55".56	1955	23° 57' 25".91	1921	23° 28' 56".65
1988	24° 25' 05".17	1954	23° 56' 35".66	1920	23° 28' 06".27
1987	24° 24' 14".92	1953	23° 55' 45'.42	1919	23° 27' 16".04
1986	24° 23' 24".67	1952	23° 54' 55".04	1918	23° 26' 25".80
1985	24° 22' 34".42	1951	23° 54' 04".80	1917	23° 25' 35'.57
1984	24° 21' 44".03	1950	23° 53' 14".55	1916	23° 24' 45".19
1983	24° 20' 53".78	1949	23° 52' 24".31	1915	23° 23' 54".96
1982	24° 20' 03".53	1948	23° 51' 33".93	1914	23° 23' 04".72
1981	24° 19' 13".28	1947	23° 50' 43".69	1913	23° 22' 14".49
1980	24° 18' 22".90	1946	23° 49' 53".45	1912	23° 21' 24".12
1979	24° 17' 32".65	1945	23° 49' 03".21	1911	23° 20' 33".88
1978	24° 16' 42.40	1944	23° 48' 12".83	1910	23° 19' 43".65
1977	24° 15' 52".15	1943	23°47'22".58	1909	23° 18' 53".41
1976	24° 15' 01".76	1942	23° 46' 32".34	1908	23° 18' 03".04
1975	24° 14' 11".52	1941	23° 45' 42".10	1907	23° 17' 12".81
1974	24° 13' 21".27	1940	23° 44' 51".72	1906	23° 16' 22".58
1973	24° 12' 31".02	1939	23° 44' 01".48	1905	23° 15' 32".34
1972	24° 11' 40".63	1938	23° 43' 11".24	1904	23° 14' 41".97
1971	24° 10' 50".39	1937	23° 42' 21".00	1903	23° 13' 51".74
1970	24° 10' 00".14	1936	23° 41' 30".63	1902	23° 13' 01".51
1969	24° 09' 09".89	1935	23° 40' 40".39	1901	23° 12' 11".28
1968	24° 08' 19".51	1934	23° 39' 50".15	1900	23° 11' 21".05
1967	24° 07' 29".26	1933	23° 38' 59".91		

Zodiacal Ages

Zodiacal Ages are conceived in relation to the regression of vernal equinox across the Rāśis. This emphasis upon vernal equinox has no justification, as it is only one of the four cardinal points that enjoyed an equal claim as reference points for Calendar in the Vedic tradition. At any point of time the equinoxes and solstices will be kindling the esoteric powers of four signs and their lords – as for example at present we have the configuration of Pisces – Virgo – Gemini – Sagittarius involving planets Jupiter and Mercury since AD 233. The preceding Age was of Aries and its quadrangular signs involving planets Mars, Venus, Moon and Saturn and the one prior to that was under the influence of Taurus and quadrangles of planets Venus, Mars, Sun and Saturn. The esoteric energies represented by the two equinoxes and two solstices can be different as may be gleaned from the seasonal characteristics associated with them.

Spring equinox: Regenerative energies
Autumnal equinox: Intellectual energies / Inquisitiveness
Summer solstice: Sustenance
Winter solstice: Spiritual quest/ Degenerative powers/ Destruction/ War

Autumnal equinox personified in the Indian tradition as Śārada, the deity of Vidyā is perhaps a better indicator of the pulse of the times. Śārada transiting Kanyā perhaps powered the revolution of intellectual knowledge in the period since AD 233 under the impact of Budha or Mercury, which signify the modern scientific wisdom.

Vernal Equinox in Rāśis & Nakṣatras

Epoch	Ayanāṃśa	Nakṣatra	Rāśi
Julian 0 date	+ 67^{0}54’32”.40	Ārdra	Mithuna
4622 BC	66^{0}40’07”.80	Enters Mṛgaśiras	
4133 BC	60^{0}	Mṛgaśiras midpoint	Enters Taurus
3645 BC	53^{0}20’9”.81	Enters Rōhiṇī	**Taurus**
3158 BC	46^{0}40’35”.16	Rōhiṇī midpoint	
2671 BC	40^{0}00’23”.97	Enters Kṛttikā	
2185 BC	33^{0}20’23”.15	Kṛttikā midpoint	
1942 BC	30^{0}00’07”.28		Enters Aries
1700 BC	26^{0}40’30”.24	Enters Bharaṇi	
1215 BC	20^{0}	Bharani midpoint	**Aries**
732 BC	13^{0}20’11”.51	Enters Aśvini	
250 BC	+ 06^{0}40’32”.05	Aśvini midpoint	
233 AD	0^{0}	Enters Revatī	Enters Mīna
713 AD	- 06^{0}39’33”	Revatī midpoint	**Pisces**
1193 AD	- 13^{0}20’	Enters U. Bhadra	
1671AD	- 19^{0}59’36”.28	U.Bhadra midpoint	
2149 AD	- 26^{0}40’04”.00	Enters P.Bhadra	
2387 AD	-29^{0}59’46”.42	Age of **AQUARIUS**	Enters Aquarius
4521 AD	-59^{0}59’40”.97		Enters Makara

Influence of the Navāṃśas

The period of 2160 years that the cardinal points take to cover a sign of 30^0 is very large to be comprehended in terms of specific planetary influence. A look at the history of civilizations suggests the need for some alternate provisions to astrologically understand the changing patterns of esoteric planetary influence over the arrow of time. Hindu Zodiac conceives each Rāśi as constituted by nine Navāṃśas of $03^0 20'$ each that are having specific planetary lordship. This brings in sign and planets influence into smaller time frames of approximately 240 years. Now [since 1909 AD] the ruling navāṃśas are:

Spring equinox: Leo → Sun
Autumnal equinox: Aquarius → Saturn
Summer solstice: Scorpio → Mars
Winter solstice: Taurus → Venus

Likewise the Piscean Age may be configured as:

Interval	Cardinal Point	Navāṃśa	Planet
AD 233 - 473	Spring equinox	Pisces	Jupiter
	Autumnal equinox	Virgo	Mercury
	Summer solstice	Gemini	Mercury
	Winter solstice	Sagittarius	Jupiter
473 - 713	Spring equinox	Aquarius	Saturn
	Autumnal equinox	Leo	Sun
	Summer solstice	Taurus	Venus
	Winter solstice	Scorpio	Mars
713 - 953	Spring equinox	Capricorn	Saturn
	Autumnal equinox	Cancer	Moon
	Summer solstice	Aries	Mars
	Winter solstice	Libra	Venus
953 - 1193	Spring equinox	Sagittarius	Jupiter
	Autumnal equinox	Gemini	Mercury
	Summer solstice	Pisces	Jupiter
	Winter solstice	Virgo	Mercury
1193 - 1432	Spring equinox	Scorpio	Mars
	Autumnal equinox	Taurus	Venus
	Summer solstice	Aquarius	Saturn
	Winter solstice	Leo	Sun
1432 - 1671	Spring equinox	Libra	Venus
	Autumnal equinox	Aries	Mars
	Summer solstice	Capricorn	Saturn
	Winter solstice	Cancer	Moon
1671 - 1910	Spring equinox	Virgo	Mercury
	Autumnal equinox	Pisces	Jupiter
	Summer solstice	Sagittarius	Jupiter
	Winter solstice	Gemini	Mercury

During 1671 – 1910, the navāṃśa influences were of:

Spring equinox: Virgo → Mercury
Autumnal equinox: Pisces→ Jupiter
Summer solstice: Sagittarius → Jupiter
Winter solstice: Gemini → Mercury

Creative and destructive aspects of scientific thinking was realized during this period in which Mercury ignited the esoteric energies of spring equinox and winter solstice traversing signs Pisces and Gemini respectively. Also Man aggressively sought sustenance from all sources inspired by the energies of Sagittarius and searched new areas of knowledge under the impact of Piscean inquisitiveness.

Present phase is Sun – Saturn – Mars – Venus, which brought in atomic energy and diseases such as AIDS, reflective of the destructive side of Saturn – Mars influence upon knowledge and degenerative aspect of Venus. Sun symbolizing the energies such as fire, atomic power etc. has come to influence the spring equinox after about 2870 years and has caused the discovery and use of atomic energy. In the remaining 150 years it is likely that even the fusion process will be domesticated and miniature suns shall ultimately become the powerhouses.



"...human intellectual endeavor does not always proceed through deductive and inductive reasoning. The key to major scientific advances often rests with free-ranging imaginative leaps or inspiration. In such cases an important fact or conjecture springs ready-made into the mind of the inquirer, and only subsequently is justification found in reasoned argument. How inspiration comes about is a mystery that raises many questions. Do ideas have a type of independent existence, so that they are "discovered" from time to time by a receptive mind? Or is inspiration a consequence of normal reasoning which takes place hidden in the subconscious, with the result being delivered to the conscious only when complete? If so, how did such an ability evolve? What biological advantages can such things as mathematical and artistic inspiration confer on humans?"

Paul Davies